

SOQUEL DEMONSTRATION

STATE FOREST

GENERAL FOREST

MANAGEMENT PLAN

**CALIFORNIA DEPARTMENT OF FORESTRY
AND FIRE PROTECTION**

**SOQUEL, CALIFORNIA
March 4, 1998**

GENERAL FOREST MANAGEMENT PLAN

FOR SOQUEL DEMONSTRATION STATE FOREST

This final General Forest Management Plan is intended to set the goals and guide the development of programs and facilities on Soquel Demonstration State Forest (SDSF). It was approved by the SDSF Advisory Committee on May 15, 1997 and by the Board of Forestry on March 4, 1998.

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INTRODUCTION

CALIFORNIA'S DEMONSTRATION STATE FOREST SYSTEM

The demonstration state forest system of the California Department of Forestry and Fire Protection (CDF) was established in the mid-1940's to furnish local needs of research, demonstration, and education related to forest management. Currently, the demonstration state forest (DSF) system encompasses over 71,000 acres of land in the form of eight state forests. DSFs are healthy, living forests which demonstrate conservation and protection of wildlife, fisheries, vegetation, soil, and watershed resources as well as sustained-yield forest management activities.

The Soquel Demonstration State Forest (SDSF), the first addition to the DSF system in over 40 years, contains 2,681 acres of coast redwood and mixed evergreen forest types. Former Assemblyman Sam Farr authored SDSF's enabling legislation, Assembly Bill 1965 of 1987 (now Public Resources Code (PRC) Sections 4660-4664), which provided for the protection and preservation of the SDSF as an intensively managed educational and research forest, and contained special provisions for the use of SDSF, including a limited amount of commercial timber operations on the property within the SDSF in order to provide funds for the maintenance and operation of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Section 4660 on SDSF. AB 1965 is reprinted in Appendix A of this plan.

SDSF was formally transferred from its interim managers, The Nature Conservancy (TNC), to CDF on July 13, 1990. Former CDF Director Harold Walt, former Assemblyman Sam Farr, a representative of State Controller Gray Davis, and Steve Johnson of TNC dedicated the Forest, emphasizing the nature and purpose of this addition to the DSF system.

SDSF is unique among California's demonstration state forests in that an advisory committee was formed to assist the Department in planning future management of the Forest. The Advisory Committee, also required by AB 1965, met monthly during the planning process to discuss draft chapters and offer suggestions to the Forest staff. While the intent of the Advisory Committee was to facilitate the creation of this General Forest Management Plan, the group will continue to meet periodically to discuss plan implementation and additional management designs.

THE GENERAL FOREST MANAGEMENT PLAN

Following the acquisition of the SDSF property (see the Administration chapter), TNC created an interim management plan for what they called the Soquel Creek Forest. Recognized as a

temporary plan, TNC's document provided direction for current and future management decisions involving SDSF. This new General Forest Management Plan incorporates elements of the TNC plan and information from other sources.

The General Forest Management Plan has been developed with input from the public and resource professionals. Public workshops were held to obtain feelings, opinions, and factual information about the management of SDSF's forest resources. Furthermore, individuals representing many interests contributed data, publications, and personal knowledge for consideration through conversation with Forest staff. Public comments and concerns relating to various subjects are summarized in each chapter. A supplemental document, titled Public Input to the Soquel Demonstration State Forest General Management Plan, presents all input received during the development of the draft plan which was completed in October, 1993.

Local resource professionals contributed a significant amount to this plan. Knowledgeable individuals served on the Advisory Committee, provided factual information about various resources, and composed elements of the plan itself. Without their assistance and experience, this management plan could not have been written.

The environmental impacts of this management plan have been thoroughly investigated by Jones and Stokes Associates, Inc. in a program environmental impact report (EIR) which was completed in compliance with the California Environmental Quality Act (CEQA). A primary objective of this program EIR is to identify mitigation measures to reduce or avoid adverse environmental impacts that could result from implementation of any SDSF projects. As required by CEQA, mitigation measures identified from this EIR have been incorporated into a Monitoring Plan located in Appendix C.

FUTURE PLANNING

As indicated throughout this plan, SDSF staff will continue to formulate more specific management guidelines and planned actions. Detailed plans for the management of components such as recreation, education, fisheries, wildlife, and fire protection, will be developed in the future.

This SDSF General Forest Management Plan will be in effect until it is either amended or a new plan is adopted in accordance with the procedures prescribed in PRC Section 4663. Working with the Advisory Committee, CDF will reexamine the General Forest Management Plan every ten years and determine whether any changes are necessary or desirable. This plan embodies the legislative intent of PRC Sections 4660-4664, and any subsequent amendments of this plan or any new plan must be consistent with the interpretations of PRC Sections 4660-4664 contained in this plan except to the extent, if any, that subsequent legislation changes that intent. If changes are desired, the changes will be

developed by CDF and presented to the Advisory Committee for consideration at one or more public meetings. The changes shall be approved by the Advisory Committee prior to adoption by the Department. Any changes will be subject to environmental review as provided by the California Environmental Quality Act.

MANAGEMENT GOALS

SDSF's management goals represent a combination of legislation, policy, and public input. PRC Sections 4660-4664, the enabling legislation for Soquel Demonstration State Forest, is the preeminent authority with regard to the management of the SDSF. Consistent with the objectives of that legislation to protect and preserve SDSF as an intensively managed, multifaceted research forest and to the extent not in conflict with that enabling legislation, the SDSF will be managed in accordance with the state forest system legislation (PRC Sections 4631-4658) and Board of Forestry policy.

Public Resources Code Section 4660 states that the intent of the Legislature in establishing the Soquel Demonstration State Forest is to provide an environment that will do all of the following:

- * Provide watershed protection for local communities and base-line monitoring and studies of the hazards, risks, and benefits of forest operations and watersheds to urban areas.
- * Provide public education and examples illustrating compatible rural land uses, including sustained yield timber production, as well as the historic development of timbering and forestry machinery, within the context of local community protection and nearby pressures.
- * Provide a resource for the public, environmental groups, elected officials, environmental planners, the educational community, and the media as an open environment for the inspection and study of environmental education, forestry practices, and effects thereof.
- * Protect old-growth redwood trees.

As is common in legislation, these objectives contain many potential conflicts and will require trade offs in implementation.

Section 4661 further states that the CDF may permit a limited amount of commercial timber harvesting in order to provide the funds needed for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF.

Below is a listing of SDSF's general management goals which elaborate on the legislative intent. Other subjects and greater detail relating to the topics listed here can be found throughout the following chapters of this General Forest Management Plan.

DEMONSTRATION AND EDUCATION

1. Conduct innovative demonstrations and education in forest management including silviculture, habitat diversity, logging methods, hydrology, resource protection, and recreation.
2. Provide forestry education opportunities for the public, forest landowners, the educational community, the media, natural resource professionals, and environmental groups.
3. Develop interpretive resources to help Forest visitors understand the various coast redwood forest communities and the basics of forest land management.
4. Establish a volunteer program to assist forest staff in providing forestry interpretation for visitors.
5. Design and construct a Forestry Education Center to serve as the Forest's focal point for demonstration and education activities.

TIMBER MANAGEMENT

1. Demonstrate sustained-yield with examples of timber harvesting at a level that is compatible with rural land use in Santa Cruz County and recreational use of SDSF and promotes forest health, watershed protection, wildlife, and fisheries values as well as aesthetic enjoyment.
2. Protect old-growth redwood and Douglas-fir trees and recruit additional late-successional forest stands.
3. Incorporate demonstration, research, and restoration objectives into timber management activities whenever possible.
4. Study hardwood stand management alternatives including modification to enhance wildlife habitat, utilization for various forest products, and conversion to softwood timber stands consistent with the legislative goals of PRC Sections 4660-4664.

RESEARCH

1. Conduct research in forestry and natural resource management, including the benefits and risks of forest operations in watersheds close to urban areas.
2. Serve as a laboratory for in-house projects and encourage research by other agencies, interest groups, and educational institutions.
3. Disseminate information obtained from the State Forest to appropriate individuals in an effective and timely manner.

RESOURCE PROTECTION AND ENHANCEMENT

1. Protect, restore, and enhance the significant natural values of the Soquel Demonstration State Forest.
2. Provide watershed protection and conduct baseline studies and monitoring of hydrological resources.
3. Demonstrate fire protection using a coordinated fire prevention and control system which includes education and enforcement of fire prevention guidelines, Forest patrol, vegetation management, fuelbreak construction, pre-attack strategies, and suppression tactics.
4. Improve fisheries and wildlife habitat to foster healthy populations and promote biodiversity.
5. Monitor and study controls for various forest pests using Departmental and outside specialists.
6. Study all significant archaeological and historical features and protect them during all management activities.
7. Conserve soil resources by reducing erosion resulting from flooding, earthquakes, logging activities, roads, and trails.

RECREATION

1. Provide for recreational opportunities which are oriented toward foot, bicycle, and equestrian traffic and include trails, roads, and picnic areas. Limited camping may be permitted in the future.
2. Integrate recreation management, forestry education, resource protection and examples of timber harvesting so as to demonstrate how they can be compatible.
3. Control fishing, the use of motorized vehicles, shooting, and hunting to provide for public safety and forest protection.

PUBLIC COMMENTS AND CONCERNS

Throughout the planning process, members of the public have indicated that adherence to SDSF's enabling legislation, AB 1965, is legally required. Neighbors and visitors of the Forest have communicated that management goals and actions should abide by the written legislation. CDF intends to abide by this plan and to act consistently with the intention of the enabling legislation as expressed in this plan.

PROPERTY DESCRIPTION

LOCATION AND BOUNDARIES

Soquel Demonstration State Forest is located in the center of Santa Cruz County, California, approximately eight miles northeast of the city of Santa Cruz (Figure 1). Positioned in the southern portion of the Santa Cruz Mountains, SDSF is eighteen air miles south of San Jose and within a two-hour drive of the San Francisco and Oakland metropolitan areas. Access to the property is via State Highway 1 or 17 and local county roads. The entrance to the Forest is from Highland Way, a county road in the Santa Cruz Mountains that connects State Highway 17 with Watsonville. Virtually all of the Forest's 2,681 acres are located within the East Branch of Soquel Creek watershed.

SDSF's boundaries were originally established by metes and bounds rather than the more familiar township and range system. Formerly part of the Soquel Augmentation Rancho (a Mexican land grant), this area has always been defined differently than the land which surrounds it. Most of the corners listed in the survey, prepared by George Dunbar of Dunbar Land Surveys, have been verified and are in place. The Santa Cruz County parcel numbers for the Forest are 098-101-04; 098-161-02, 06; and 099-181-02, 03, 04, 06.

ADJACENT OWNERSHIP

SDSF is bordered by both state and private property (Figure 2). The Forest of Nisene Marks State Park borders the State Forest for three and one-half miles along Santa Rosalia Ridge to the south. Approximately three-hundred-forty acres directly east of the Forest boundary are owned by Roger and Michelle Burch. This land is managed by Redwood Empire and includes the main entrance and parking area for the Forest off Highland Way. To the north and west, the adjacent ownerships are private rural-residential parcels, including the large holding of Spanish Ranch. Most of these parcels range in size from 1 to 80 acres. On the southwest border is the property containing the Olive Springs Quarry, owned by the CHY Company.

With the considerable amount of private property surrounding the Forest, public access is currently limited. The only undisputed public access points into the Forest are from Highland Way and The Forest of Nisene Marks State Park.

Figure 1. Locator map for SDSF.

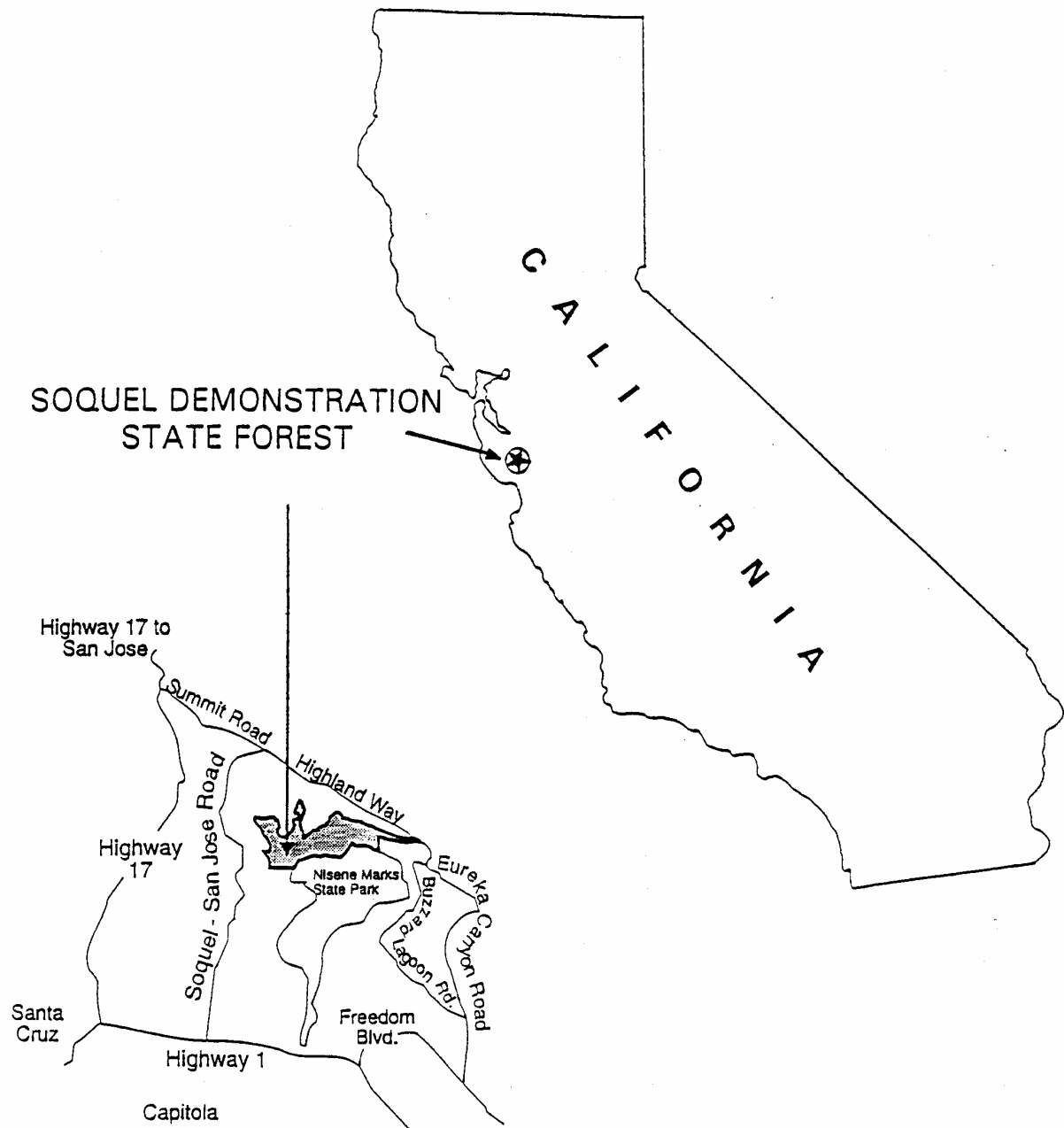
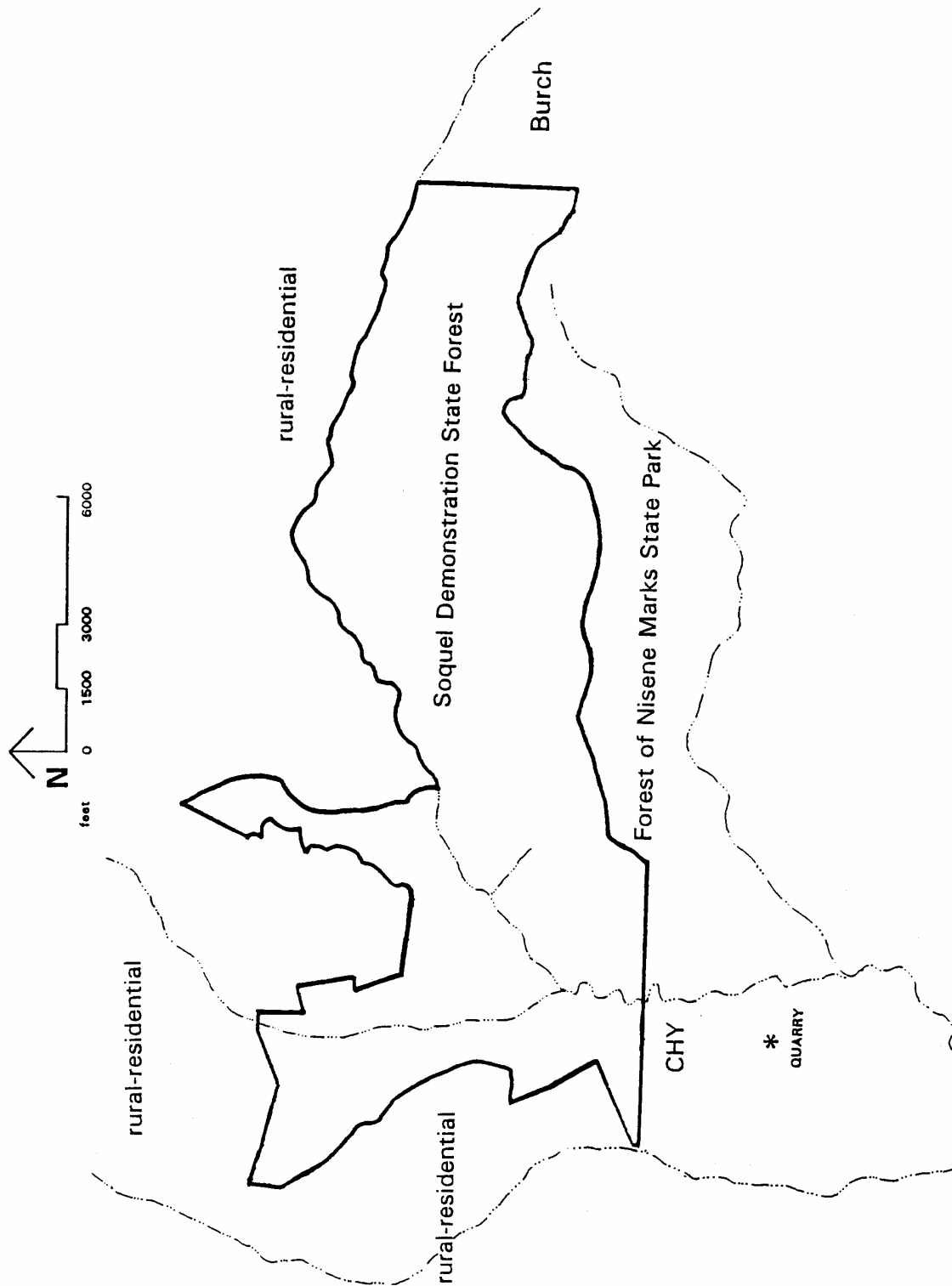


Figure 2. SDSF and adjacent ownerships.



HISTORY OF OWNERSHIP

Prior to the arrival of Europeans, the Costanoan (also known as Ohlone) Indians inhabited the area. In the mid-1800's, the title to the 32,000-acre Soquel Augmentation Rancho was awarded to Martina Castro de Depeaux viuda de Lodge viuda de Cota, the daughter of a Spanish Colonial soldier. SDSF was contained within the rancho, and Martina gave this portion to her daughter, Antonia Lodge de Peck. Frederick A. Hihn, a German-born entrepreneur, was able to acquire portions of the Soquel Augmentation through a discrepancy in legal title. He was particularly interested in Lodge de Peck's parcel and purchased it in 1863.

In the 1880's, Hihn established the Valencia-Hihn Company and began selectively logging the old-growth redwood on his lands to produce shingles, posts, and rails. Upon his death in 1913, Hihn's heirs assumed management of his lands and continued to harvest the area. In 1924, the Valencia-Hihn Company sold their land to the Monterey Bay Redwood Company (MBRC). The MBRC owned the State Forest property for 37 years and performed extensive harvest in the 1920's and '30's. They sold their property to the Glenco Forest Products Company of Sacramento in 1961, which later changed its name to the CHY Company. Eighteen years later, in 1979, CHY sold the State Forest portion of their land to the Pelican Timber Company. Additional details about the history of the Forest can be found in Brian Dillon's Archaeological and Historical Survey of Soquel Demonstration State Forest (1992).

In 1988, Pelican was involved in a debt-for-nature land swap with the State of California and the Bank of America (see the Administration chapter for more details). A result of this land swap was the creation of SDSF as authorized by former Assemblyman Sam Farr's Assembly Bill 1965. The Nature Conservancy acted as the interim managers of the Forest until its transfer to CDF in 1990.

CLIMATE

The climate of the Santa Cruz Mountains is Mediterranean, characterized by dry, warm summers and wet, cool winters. SDSF is usually cool and damp because of the dense canopy of forest vegetation and its location on a north-facing slope. The average minimum January temperature is 38 degrees Fahrenheit, and the average maximum July temperature is 76 degrees Fahrenheit.

Most of the precipitation in the area occurs from November through April. The average annual rainfall for the East Branch of Soquel Creek is 44 inches (Linsley et al., 1992). At elevations above 2,000, snowfall occurs about every other year and averages less than five inches total.

During the late spring and early summer months, Santa Cruz County often has foggy or cloudy skies. In the Forest, this is generally limited to early morning and late evening hours.

Winds generally blow from the west or southwest (onshore) and are mild to moderate throughout the year. Strong winds, however, come in with winter storms and are strongest at higher elevations. Pressure gradients inland may occasionally cause strong northeasterly winds to occur.

SOILS AND GEOLOGY

SOIL TYPES

The parent material of soils found in SDSF is primarily sedimentary and consists of fine and coarse-grained sandstone, consolidated shale, weathered mudstone, and siltstone. Schist and intrusions of granitic rock are also present. There are nine soil series which developed from these parent materials (Table 1 and Figure 3). They are all deep and well-drained soils except for the Maymen Stony Loam which is a shallow, well-drained soil. According to the Soil Conservation Service (1980), most of the soils support watershed, recreation, and wildlife resources. Five of the soils (Ben Lomond, Felton, Lompico, Nisene, and Aptos) also support timber production, with the primary species being coast redwood and Douglas-fir.

GEOLOGIC ACTIVITY

In 1992, a detailed geologic study was completed by Michael Manson and Julie Sowma-Bawcom of the California Division of Mines and Geology. This investigation resulted in a report which focuses on the process and degree of instability in both the State Forest and surrounding areas. The report, titled Geology, Slope Stability, and Earthquake Damage in Soquel Demonstration State Forest, includes maps of general geologic and geomorphic characteristics, landslide features (indicating the relative degree of stability), stream orders, roads to be considered for abandonment, and Alquist-Priolo Special Studies Zones. (Alquist-Priolo Special Studies Zones are areas along traces of the San Andreas Fault where geologic investigations are required prior to development.)

SDSF is seismically very active. The San Andreas Fault runs through the northeastern boundary and along the East Branch of Soquel Creek to the mouth of Ashbury Gulch, where it turns north. The Zayante Fault, part of the San Andreas Rift Zone, runs through the southwest edge of the Forest. The epicenter of the 1989 Loma Prieta Earthquake was located approximately 2 miles south of SDSF, in The Forest of Nisene Marks State Park. Numerous cracks and fissures dating from the 1989 earthquake have been located in the State Forest.

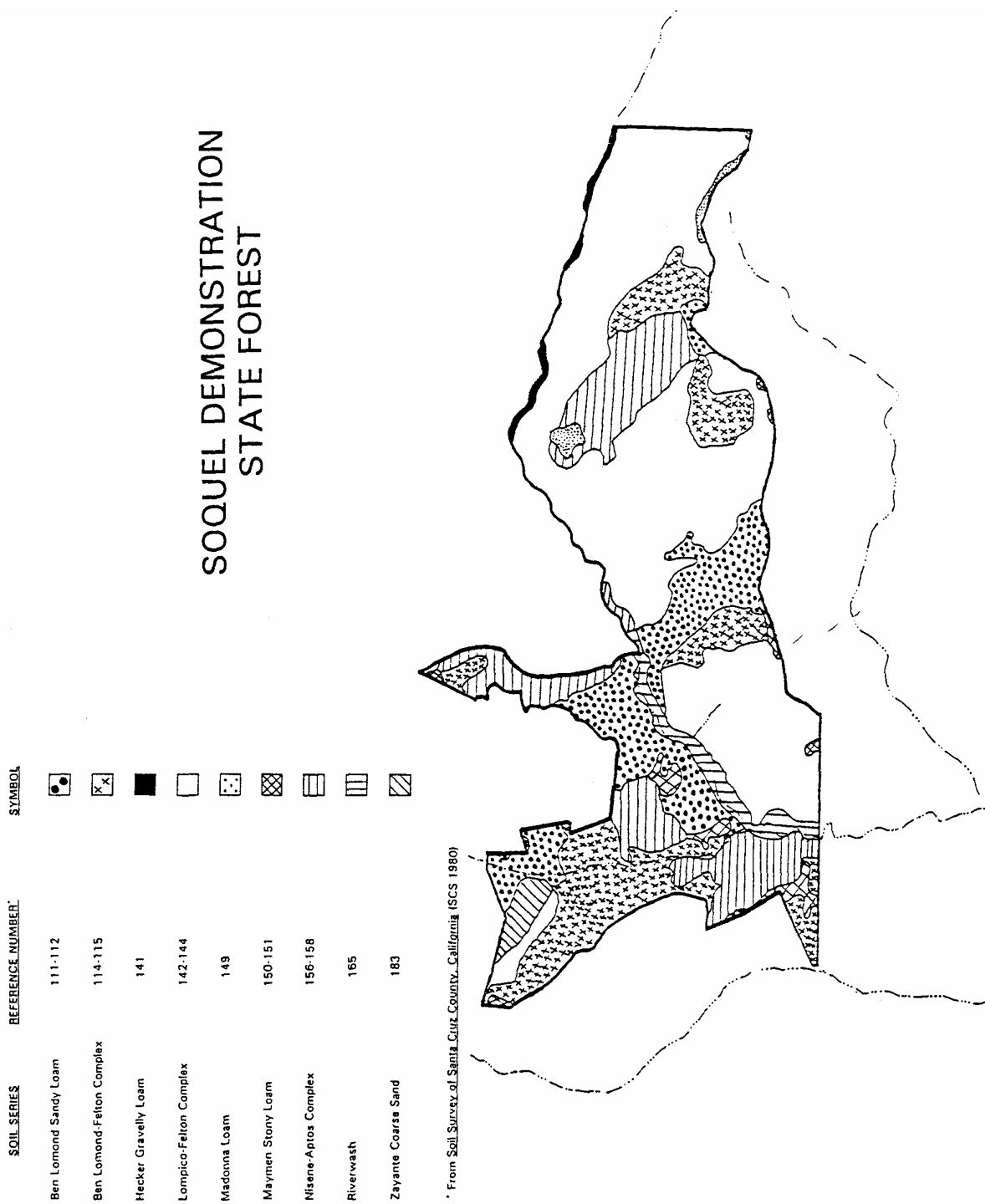
Geologic activity, coupled with past fires and severe rain storms, has helped form the steep terrain found throughout the Forest. These events have also contributed to the many landslides present within the inner gorges of streams and along steep roadcuts. The numerous natural springs and sag ponds found throughout the Forest are also the result of past geologic activity.

Table 1. Soil types and associated erosion hazard of SDSF.*

SOIL TYPE	PERCENT SLOPE	PERCENT ACRES	EROSION HAZARD
Ben Lomond sandy loam	15-50	1.77	moderate to high
Ben Lomond sandy loam	50-75	11.61	very high
Ben Lomond-Felton Complex	30-50	0.66	high
Ben Lomond-Felton Complex	50-75	15.81	very high
Hecker gravelly loam	50-75	0.48	very high
Lompico-Felton Complex	5-30	7.44	moderate to high
Lompico-Felton Complex	30-50	23.95	high
Lompico-Felton Complex	50-75	14.71	very high
Madonna loam	15-30	0.88	high
Maymen stony loam	15-30	0.06	high
Maymen stony loam	30-75	1.97	high to very high
Nisene-Aptos Complex	15-30	1.90	moderate to high
Nisene-Aptos Complex	30-50	6.76	high
Nisene-Aptos Complex	50-75	7.62	very high
Riverwash	-	2.94	-
Zayante coarse sand	30-50	1.44	moderate to high

*From Soil Survey of Santa Cruz County, California (SCS, 1980)

Figure 3. Locations of soil series in SDSF.



The elevation of SDSF ranges from 500 feet at the East Branch of Soquel Creek to 2,500 feet at the southeast corner on Santa Rosalia Ridge. The higher elevations occur in the southeast portion of the Forest and decrease along the ridge going southwest.

WATER RESOURCES

The East Branch of Soquel Creek is a perennial stream that flows through the entire length of the Forest. It is fed by the perennial streams of Fern Gulch and Amaya Creeks from the north, and numerous unnamed intermittent and ephemeral streams. The total size of the East Branch watershed is approximately 19 square miles or 12,240 acres.

As previously mentioned, natural springs and sag ponds can be found in the Forest. The two largest springs are Sulphur Springs, located on the Sulphur Springs Trail, and Badger Springs, located near the main picnic area. Badger Springs was at one time a developed water source as is evident by the remains of a spring box and steel pipes scattered around the area. A third spring, located east of Sulphur Springs along Hihn's Mill Road, was created by the 1989 earthquake.

Amaya Pond, a seasonal body of water, is located in the northwestern arm of the Forest. Approximately one-half acre in size, it is located on the east side of Amaya Road, approximately one-third of the way down from Comstock Mill Road. (See Preliminary Biological Assessment of Soquel Demonstration State Forest, Santa Cruz County, California, [Holland et al., 1992] for more details about Amaya Pond.)

The portion of the East Branch that runs through the Forest is well known for its steelhead rearing habitat. The California Department of Fish and Game prohibits angling in this part of the Soquel Creek watershed in order to protect this important resource. The Fisheries chapter of this report contains more information on the creek and its fisheries assets.

Soquel Creek, including the East Branch, is also part of the domestic water supply for the local community. The lower portion of Soquel Creek serves as part of the natural groundwater recharge system for residents' wells and supplies surface water to a number of intakes along the creek. (See the Fisheries and Watershed chapters for additional information on watershed condition, use, and management.)

ZONING AND GENERAL PLAN

SDSF is entirely classified as Timber Production Zone (TPZ). As defined in Government Code Section 51104(g) and consistent with Sections 51112 and 51113, TPZ land is devoted to and used for growing and harvesting timber and other compatible uses as

defined in Section 51104(h). Compatible uses include but are not limited to watershed management, fish and wildlife habitat management, and outdoor education and recreation activities.

The Santa Cruz County General Plan designates the Forest land as Mountain Residential. Objectives of this use include protection of natural resources, retention of rural character, and maintenance of a healthy environment.

CHARACTERISTIC FEATURES

A distinctive feature of SDSF is its proximity to the large urban areas of San Francisco Bay, Monterey Bay, and San Jose. This provides prime opportunities for urban children to experience forestry education on a first-hand basis.

The natural springs of Sulphur and Badger, as well as other unnamed springs, are also special to SDSF. These springs, plus Amaya Pond, enhance particular biotic communities and offer various research opportunities.

The presence of steelhead trout and a portion of the Soquel Creek watershed also contribute to the special characteristics of SDSF. The watershed, second only in size to that of the San Lorenzo river, represents a system limited to the coastal side of the Santa Cruz Mountains. One of the largest reasons for this is the presence of steelhead trout, an anadromous fish species. Once abundant along the entire west coast, steelhead populations have declined due to habitat loss and several other factors. The East Branch of Soquel Creek, the portion of Soquel Creek that flows through the Forest, supports a steelhead population and its required habitat. Although coho salmon are not currently present, their habitat still exists in the watershed.

As mentioned above, the San Andreas Fault and Rift Zone are directly associated with SDSF. The effects of both ancient and contemporary seismic activity are apparent throughout the Forest. The history and future of this very active system make for an interesting addition to SDSF's abundant natural features.

Finally, the Forest contains six archaeological sites which were discovered during the archaeological survey (Dillon, 1992). The Archaeology Chapter of this report describes the sites and their significance in detail. Both prehistoric and historic, these sites will enhance SDSF's demonstration and education programs.

ADMINISTRATION

THE LEASE

On March 7, 1988, State Controller Gray Davis and the Bank of America settled a thirteen-year long lawsuit over unclaimed bank accounts. The settlement included \$35.7 million in cash and four undeveloped natural parcels in Tehama and Sonoma Counties. The property that is now SDSF was acquired during the settlement process and added to the package.

The settlement properties are held in a trust with the State as the beneficial owner and the Bank of Tehama County and the Bank of California as co-trustees. The properties can be sold to pay unclaimed funds if they exceed the \$35.7 million in cash set aside for this purpose. It is doubtful, however, that this will ever happen.

At the time of the settlement, The Nature Conservancy (TNC) volunteered to act as steward for these properties. A 25-year lease was developed which stated that TNC would manage these properties and that past land use practices could continue. Any revenues generated from these activities were to pay for property taxes, operations and maintenance, natural resource enhancement, and access improvement projects.

The Nature Conservancy transferred their lease of the Santa Cruz county property (now SDSF) to CDF on April 18, 1990. CDF assumed management at that time and a dedication ceremony for SDSF was held on July 13, 1990. At the end of the 25-year lease, the property will be transferred permanently to the State, free and clear.

Under the terms of the lease, both the co-trustees and the Controller have certain rights and responsibilities. The trustees' primary responsibility is to monitor the lessee's performance as managers of the properties. The Controller is responsible for the sale of any or all the properties in the event that cash assets are insufficient to satisfy all claims. As previously mentioned, this is unlikely to ever happen.

CDF ADMINISTRATION

Authority to *administer and operate* state forests in California comes from the Legislature and is contained in the Public Resources Code (Sections 4631-4664 and 4701-4703). Rules and regulations governing *use* of state forests are contained in the California Code of Regulations (Title 14, Sections 1400-1439 and 1510-1521). The State Board of Forestry gives policy direction to the Demonstration State Forest Program, which is administered by the Director of CDF.

CDF is administratively broken into two Regions, each with a Region Chief who reports to CDF's Director. Each region includes ranger units, and state forests are administered by a local Ranger Unit Chief. SDSF is in the Coast/Cascade Region (with headquarters in Santa Rosa) and is within the San Mateo-Santa Cruz Ranger Unit (headquartered in Felton). The State Forest office is located next to the CDF Soquel Forest Fire Station at 4750 Soquel-San Jose Road in Soquel, California. SDSF has a staff of four: Forest Manager, Assistant Forest Manager, half-time Office Assistant, and seasonal Forestry Aide. The Forest Manager is supervised by the Ranger Unit Chief.

The Forest staff is responsible for the on-site operation of the Forest as provided for by the Public Resources Codes, California Code of Regulations, and the State Board of Forestry. Forest regulations, policy, and other issues prescribed by the Director of CDF are used to develop plans and procedures to govern development and perform maintenance of the Forest. The General Forest Management Plan will be reviewed and approved by SDSF'S Advisory Committee (described below) and ultimately approved by the Director of CDF and the Board of Forestry.

FUNDING AND TAXES

The Demonstration State Forest Program, including SDSF, is funded through the regular annual state Budget Act. AB 1965 did not establish a separate fund for SDSF and it is not listed as a line item in the state budget. Revenues from all state forests are deposited in a special fund called the Forest Resources Improvement Fund (FRIF), providing money for the annual budgets of state forests, the Forest Practice Program, the California Forest Improvement Program (CFIP), and other CDF programs.

Expenditures for all state forests are included in a single budget line item in the Department's annual budget. Soquel State Forest was added to the Department's state forest budget in the 1990-91 fiscal year with a minimum of staffing and operating expense. The Budget Change Proposal recognized that there would be little revenue from SDSF for the first few years and that FRIF would need to contribute over one million dollars in operating expense before the Forest could produce revenue. It was also recognized that many years would pass before revenues would equal expenses.

The Department may permit a limited amount of commercial timber operations on SDSF in order to provide funds on a cumulative basis as necessary for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF. The enabling legislation requires a minimum level of timber harvesting, that we call a floor, to provide income for all costs of operation and for research and educational purposes of SDSF. The legislation authorizes a higher level of harvesting, which we call a ceiling, which shall not exceed long-term sustained yield

(LTSY) and on a cumulative basis shall not exceed the level of timber harvesting necessary to provide the funds needed for the maintenance and operation expenses, reasonable capital costs, and other expenses incurred in fulfilling all the objectives identified in PRC Sections 4660-4664 on SDSF. These additional objectives include watershed protection and monitoring, and demonstrations of compatible rural land uses and historic development of timbering and forestry machinery.

As a practical matter, the various objectives overlap and cannot be completely separated. For example, demonstration or experimental timber harvesting could qualify as research and public education as well as an example of compatible rural land uses. The protection of old-growth redwood trees will occur under normal operations of SDSF and does not need to be identified as a separate purpose with separate funding.

Funding for SDSF needs to be increased over time in order to fulfill the objectives of PRC 4660-4664. In order to adhere to the administrative and budgeting processes currently in place while simultaneously assuring compliance with the limitations placed on the Department by the enabling legislation, the Department will publish accurate annual reports which will compile revenues, expenses itemized by program, and cumulative balances. The Department will maintain a mailing list for requests of annual distributions of the report. Large capital expenses (e.g., for additional properties to provide proper access to SDSF or for construction of a Forestry Education Center and administrative facility) will be funded through the FRIF fund or any fund source approved by the Legislature. Amortization of these capital outlays may be included in the computation of cumulative expenses in the annual reports.

The State pays property taxes to the County of Santa Cruz on land values within SDSF. Additionally, purchasers of state forest timber are liable for payment of timber yield taxes according to Public Resources Code, Section 4654. SDSF's timber sale purchasers are required to file quarterly tax returns with the California Board of Equalization.

ADVISORY COMMITTEE

The legislation which created SDSF (AB 1965) called for the establishment of an advisory committee to assist with the development of SDSF's General Forest Management Plan. A main function of the committee is to act as a critical link between CDF and the community in the planning effort. This allows SDSF to learn what the community expects and how they feel about certain issues.

The Advisory Committee has nine members appointed by the Director of CDF in August of 1991. Five positions were specified by the legislation and four were added by the Director. The committee consists of one representative from each of the following:

- * State Board of Forestry
- * Santa Cruz County Board of Supervisors
- * California Department of Parks and Recreation
- * California Department of Fish and Game
- * The Forest of Nisene Marks State Park Citizens Advisory Committee
- * The Nature Conservancy
- * Soquel Creek Water District
- * Neighborhood Representative
- * Local Registered Professional Forester

The Committee held monthly meetings during the development of the draft General Forest Management Plan. Following its approval, the group will meet twice a year or as needed to review progress on plan implementation and contribute to on-going planning activities. Each member serves a three-year term or until the General Forest Management Plan is completed (whichever is longer). Once these conditions have been met, one third of the members' terms shall expire on the last day of each year.

SAFETY

The remote and rustic character of SDSF makes safety an important management consideration. Forest visitors need to be informed of safety issues and hazards inherent to the Forest. Roads, trails, and facilities are maintained in safe condition. The staff coordinates with local CDF forest fire stations and the county sheriff's office for emergency medical response; Forest personnel, including volunteers, will be trained in first-aid. Additionally, search and rescue organizations are allowed to train in the Forest so as to develop their skills and better acquaint themselves with the terrain.

The following safety protocols are currently in place:

- * Restriction and regulation signs are posted at Forest entrances. Hazards, safety issues, and the primitive nature of the area are stated on signboards and in the SDSF brochure.
- * The staff works with the California Department of Parks and Recreation to provide trail maintenance, safety, and coordinated emergency response along the common boundary.
- * All trails and roads are regularly inspected. Fallen trees and other hazards are removed as needed to maintain safe conditions.
- * Motorized vehicles are prohibited beyond designated parking areas. Exceptions are made through special permission and for management, patrol, and emergency purposes.

- * Coordination with CDF's Emergency Command Center in Felton and the county sheriff's office ensures effective emergency response in the Forest. All responses for emergency assistance will be recorded and compiled, including calls for police, fire, medical, or search and rescue services. (Refer to Appendix C, Monitoring Plan.)

LAW ENFORCEMENT

Forest regulations and policies are posted on signs and enforced through patrol and apprehension of violators (also see the Resource Protection chapter). CDF peace officers, authorized under the California Penal Code, will be used to detain violators, with local law enforcement agencies providing backup when necessary. The Department of Fish And Game wardens will enforce fishing, hunting, and trapping laws. Seizure and prosecution of violators shall be actively pursued. Violators will generally be cited and expected to appear in court, but may be taken into custody if warranted. Methods to prevent illegal activities and alternatives which curtail unwanted behavior will be explored and developed to reduce law enforcement problems.

State Forest trespass violators will normally be cited under sections of the California Code of Regulation (Title 14). Illegal trespass includes removal of trees without a permit and parking, camping/campers, or building in the Forest.

Marijuana cultivation in the Forest has been relatively minor. Since the dedication of the Forest, the remnants of six old gardens have been found and three active gardens have been eradicated. The general inactivity of marijuana cultivation is due in part to the majority of the Forest being south of the East Branch of Soquel Creek with a northern exposure. Furthermore, SDSF is inaccessible by vehicles and, therefore, is not readily available for use.

Detection of marijuana gardens will occur during normal patrol activities or as leads are developed. Most detection efforts will depend on flights by the Santa Cruz County Sheriff's Marijuana Eradication Program. Information about gardens found in SDSF will be referred to the sheriff's office.

ACCESS NEEDS

As stated in the Soquel Demonstration State Forest Recreation Study Final Report (McNally and Hester, 1993) and the Recreation chapter, Forest access is a significant problem and complex issue. Trespass across private property to and from the Forest comprises the bulk of these problems.

The SDSF property came into state management with two verified legal access routes (see the Roads and Other Improvements chapter

for more details). The first is an administrative and public right-of-way through the Burch property off Highland Way. The second is across CHY Company property, through the Olive Springs Quarry, which includes a right-of-way for administrative use only.

Many visitors come in via Ridge Trail from The Forest of Nisene Marks State Park. Some recreationists, particularly equestrians, have permission to pass through private property to enter the Forest. The public's use of Comstock Mill Road is prohibited because road conditions are unfavorable.

There is an obvious need to develop better access into the State Forest, particularly along the south and west ends where most trespassing occurs. It is important to provide Forest visitors with additional safe and legal access in order to reduce trespass onto private property. Furthermore, alternative access points are necessary when slides close Highland Way.

LAND ACQUISITION PRIORITIES

Land acquisition which would improve access to SDSF is a top priority. This has been actively pursued since the dedication of the Forest. Negotiations with various neighboring property owners regarding appropriation and/or easements have been ongoing. Acquisition of parcels owned by the Noren family and the CHY Company are currently being considered. Any land acquisitions funded by timber harvest revenues from SDSF shall be limited to those which improve access to SDSF or otherwise directly enhance SDSF. All acquisitions for SDSF will comply with CEQA.

Another acquisition priority is the Burch property which contains the entrance to the Forest (see Figure 2 in the Property Description chapter). The benefits of this procurement would include access control, additional areas for resource management and recreational visitor use, and a location for an informational kiosk and restroom. There would also be clear authority and responsibility for maintenance of and improvements to the bridge, roads, and parking area.

A third priority is the purchase of an area for SDSF's Forestry Education Center (FEC; see the Demonstration and Education chapter for more information). Further study is needed, however, to determine the overall function of the FEC and the facilities and programs necessary to render it successful. Once this has been completed, the amount of property needed and the best site can be determined.

COOPERATION WITH ADJACENT LANDOWNERS

As the previous CDF Director, Harold Walt, indicated at SDSF's dedication ceremony, it is important for SDSF to cooperate with their neighbors. Forest staff will continually work with the

community regarding local issues. These issues include fire prevention, trespass, watershed impacts, fisheries restoration in the East Branch of Soquel Creek, and mitigation of recreational and timber harvest impacts. The staff already works with local schools in forestry education and also coordinates fire prevention programs with local CDF forest fire stations.

COOPERATION WITH OTHER AGENCIES AND INSTITUTIONS

SDSF cooperates with other agencies in resource protection, fire prevention and suppression, law enforcement, and safety. Cooperation is also encouraged for demonstration, forestry education, and university research projects. Other agencies that work with SDSF include the California Department of Parks and Recreation, California Department of Fish and Game, and County of Santa Cruz. Cooperative institutions of learning and research include UC Santa Cruz, Cabrillo College, California Polytechnic State University at San Luis Obispo, San Jose State University, UC Berkeley, and local public schools.

PUBLIC COMMENTS AND CONCERNS

Public comments and concerns involving the administration of SDSF have largely been focused on the issue of safe and legal access but have also touched upon the FRIF program and Advisory Committee composition.

Suitable public access into SDSF is a major concern for neighbors, users, and Forest staff. As previously stated, there is an obvious need to develop adequate entry and exit points and to stop illegal trespass. Several individuals have made specific requests regarding the location of access points, usually focusing on the area from Olive Springs Quarry to Comstock Mill Road. However, neither end is owned or controlled by the state and only administrative access is allowed. SDSF will continue working with its neighbors and on potential access acquisitions to alleviate this complex and pressing issue.

During the process of establishing SDSF and creating the General Forest Management Plan, questions regarding the purpose and use of FRIF monies have been raised. As required by the Public Resources Code, all revenues from SDSF's timber sales must go into FRIF to be managed and allocated. As part of a state agency, SDSF will adhere to the requirements of FRIF as outlined by law.

Finally, neighbors of the State Forest have expressed that they would like greater representation on SDSF's Advisory Committee. Letters were written to CDF Director Richard Wilson by both neighbors and the committee chairman requesting a review of the public's concerns. After a careful and lengthy evaluation, the Director determined that the committee composition was adequate due to strong current local representation.

BIOTA

INTRODUCTION

Biota are defined as the flora (vegetation) and fauna (wildlife) which inhabit a particular area. When people envision forests, such as SDSF, biotic elements are what generally come to mind. Biota, however, are only one element of an ecosystem, small pieces of the larger puzzle.

An ecosystem has been defined by Hunter (1990) as "the interacting populations of plants, animals, and microorganisms occupying an area, plus their physical environment." The physical environment consists of abiotic factors such as soil, water, space, and climate. The presence and actions of humans make up a yet another component of ecosystems. Though humans often consider themselves to be separate entities, at a basic level they are part of the biota and are intricately connected to everything in an ecosystem. When biotic, abiotic, and human components of a forest ecosystem are working together in dynamic balance, diverse biota and healthy forests are attained. (Dynamic balance refers to the continual interaction of ecosystem components which leads to a balanced yet constant state of change.) In real life, there are rarely clear boundaries between adjacent habitat communities or even ecosystems. Ecosystems and habitats blend and overlap but can be given a label based on general wildlife, vegetation, and location features. Management planning for ecosystems or habitat communities which looks at landscape patterns caused by this overlap can benefit all inhabitants, whether they be stationary (e.g., plants) or mobile (e.g., animals).

In this chapter, the biota are described for each habitat type, or community, found in the Forest. Only the most common plants and animals found in these communities are mentioned, but complete flora and fauna lists are located in Appendix B. For a more detailed account of the biota of SDSF, refer to Preliminary Biological Assessment of Soquel Demonstration Forest, Santa Cruz County, California (Holland et al., 1992). For specific information about trees (size, abundance, etc.), see the Timber Management chapter.

Fisheries resources are described in a separate chapter that also deals with aquatic invertebrates. Though terrestrial invertebrates (e.g., terrestrial insects) are critical to terrestrial vertebrate communities, very little inventory or monitoring work has been done to date in SDSF. In the future, more work will be completed in this field. In fact, the State Forest offers prime opportunities for study and research involving terrestrial invertebrates.

HABITAT COMMUNITIES

Communities consist of the living organisms collectively found in an ecosystem (Hunter, 1990). Even though considerable overlap often occurs, communities are individually labeled and classified for research, inventory, and education purposes. They are generally named for the dominant plant species within each community. The dominant plant species is dependent on specific environmental conditions (e.g., soil, climate, water) that further characterize the community. Because communities overlap, plants indicative of one habitat type may be found in others. Poison oak, for example, can be found growing in virtually all of the communities of SDSF but is most abundant in drier habitat types. Also, some fauna considered to be permanent residents of a particular community actually travel through several communities. These animals, including large mammals (deer, bobcat, gray fox, mountain lion), can be found throughout SDSF as they search for food, water, and shelter.

COAST REDWOOD FOREST COMMUNITY

The coast redwood forest is dependent on areas of high moisture. In its northern range, large continuous stands of redwood are formed. Southern redwood forests are restricted to moist canyon slopes and riparian zones since more moisture is available in these areas. As its name suggests, the dominant tree of this community is coast redwood, the majority of which in the State Forest are second growth (regrowth after original clearcutting). Small groves of old-growth redwoods occur at Badger and Sulphur Springs, and individual old-growth redwood trees are scattered throughout the Forest. Other common trees of this community are tanoak, Douglas-fir, and madrone. Understory species found in the redwood community of SDSF are redwood sorrel, California hazel, wild ginger, and western sword fern. Common wildlife residents are pygmy nuthatch, Steller's jay, and Trowbridge's shrew. The redwood community provides nesting habitat, cover, and food for birds and a variety of small mammals. Redwood forests have comparatively little forage value for deer and other large mammals, however, limiting use of this habitat type.

MIXED EVERGREEN FOREST COMMUNITY

This forest community is dominated by tanoak and Douglas-fir; secondary tree species are madrone and California bay (Holland et al., 1992). Mixed evergreen forests are on the drier slopes above the redwood community, though the two overlap considerably. In fact, the presence or absence of redwood is the only significant difference in dominant vegetation (Holland et al., 1992). Mixed evergreen refers to a combination of conifer and hardwood trees that do not drop their leaves in the fall. Common understory species include poison oak, California blackberry, vetch, toyon, and yerba buena. Familiar wildlife residents are Merriam's chipmunk, dusky-footed woodrat, western gray squirrel, California slender salamander, acorn woodpecker, sharp-shinned hawk, and screech owl. Evidence of feral pig

activity is also found throughout the community. Oak trees of these areas have very high value for wildlife, providing both nesting and roosting substrates and a food source through acorn production.

RIPARIAN COMMUNITY

Riparian communities are named for the intermittent or continual presence of fresh water rather than the vegetation of such areas. Riparian communities are located along the edges and floodplains of streams or surrounding lakes. In SDSF, an abundant riparian community exists along the floodplain of the East Branch of Soquel Creek and to a lesser degree along Amaya Creek. This community is dominated by deciduous hardwoods such as white alder, bigleaf maple, black cottonwood, and California sycamore. Along with these trees, red and yellow willows grow in dense clumps along the banks of the East Branch. Horsetails and hedge nettles are common ground cover along the edges. Wildlife residents include vireos, warblers, Pacific-slope flycatcher, long-tailed weasel, and raccoon. Pacific newts, brown-colored salamanders with bright orange bellies, are abundant in the riparian community and a great delight to young forest visitors. The Pacific tree frog, thought to be common, is only found in a few locations (Holland et al., 1992). Additionally, large colonies of ladybug beetles gather along creeks to overwinter and breed.

Riparian communities are the most productive terrestrial habitat type for wildlife because of structural diversity and the presence of water. Many migratory songbirds are dependent on riparian habitat for breeding and foraging. Large mammals use the riparian zone as a water supply, and incorporate it into their home ranges. The riparian community is probably the most significant habitat type in the Forest due to its high value to wildlife and limited regional occurrence.

OTHER COMMUNITIES AND ADDITIONAL SPECIES

There are a few other limited communities present in SDSF. Freshwater marshes are areas where the soil stays wet a good portion of the year, supporting characteristic vegetation. These marshes usually occur along the perimeter of ponds, at springs, near shallow pools of streams, or in areas of high water tables. The freshwater marsh community in SDSF is scattered, including only Amaya Pond and a few natural springs (Sulphur, Badger, and a couple of small, unnamed springs caused by or increased from the Loma Prieta earthquake). Wildlife residents include migratory waterfowl, great blue heron, black phoebe, belted kingfisher, and garter snakes.

Less than five acres of SDSF are comprised of grassland communities. Some of these areas are natural, due to soil conditions conducive to permanent grassland establishment. Other grassland areas are the result of past disturbance. SDSF's grasslands primarily contain wild oats and annual fescue grasses.

Most grasslands are being encroached upon by coyote brush, lupine, poison oak, and Douglas-fir. Common wildlife residents of the grasslands are the gopher snake and Botta pocket gopher.

The chaparral community exists along the exposed ridge tops and on south-facing slopes at higher elevations. These dry locations support the fire-resistant woody shrubs of manzanita, buck brush, coyote brush, and chamise. Common wildlife residents are Bewick's wren, California towhee, scrub jay, western fence lizard, and brush rabbit.

Exotic (i.e., non-native) plant species occur in disturbed areas along roads and the picnic area at Badger Springs. The most common exotics are French broom, periwinkle, and pampas grass. Most exotic species have little value for native wildlife and displace native plant species that have higher intrinsic and wildlife values.

FUNGAL RESOURCES

A local mycological organization has identified a wide variety of mushrooms in the Forest (refer to Appendix B). Fungi are broken into three categories based on their relationship to the immediate environment: mycorrhizal, saprophytic, and parasitic. Saprophytic fungi occur on wood that is already dead whereas parasitic fungi attack and can kill live trees. The most common fungi found in SDSF are mycorrhizal.

Mycorrhizal species form a symbiotic relationship with the trees they grow under. These organisms grow around the rootlets and collect water and trace nutrients for use by trees. The trees in turn provide carbohydrates to the fungi. Trees and mycorrhizae, therefore, depend on one another for optimum health. According to Nathan Wilson (1993), SDSF is a reasonably healthy forest because of the wide occurrence of mycorrhizal fungi.

In general, mycological research of California's wildlands has been minimal, particularly regarding conditions conducive to fungi growth. SDSF provides ample opportunities for mycological research including fungi population analysis and succession of fungal species in the Forest. To protect the fungal resources of SDSF, a permit system for mushroom collection will be maintained and the effects of collection monitored.

SPECIAL-STATUS WILDLIFE SPECIES

The biological assessment of the Forest conducted in 1991-92 found no threatened or endangered plant or wildlife species. In 1994, however, there was an unconfirmed sighting of a California red-legged frog during a stream habitat survey (Anderson and Brown pers. comm.). Additionally, a few wildlife species of special concern to the State of California have been seen in SDSF (Holland et al., 1992 and CDF, 1994). Those species observed

were the foothill yellow-legged frog, western pond turtle, sharp-shinned hawk, Cooper's hawk, and golden eagle. The long-eared owl and yellow warbler may also occur in the Forest, but they have not been observed (Table 2). Suitable breeding, nesting, or foraging habitats exist in the Forest for all species observed except the golden eagle.

PUBLIC COMMENTS AND CONCERNS

A major theme regarding the management of SDSF's biota involves species evaluation and monitoring, particularly for special status species. Comments have largely focused on fauna though concern about edge vegetation and introduced plant species has been expressed. As stated in the Management Guidelines and Planned Actions below, SDSF plans to monitor selected biotic elements of the Forest and evaluate effects of forest management activities on the condition of those resources.

Another primary concern is the restoration of degraded habitats and maintenance of exceptional resource values in SDSF. Emphasizing this concern are comments regarding management of habitats individually (e.g., manage riparian habitats separately from mixed evergreen habitats) and management activities which allow interior forest species to thrive. Many commentators feel that development and management of SDSF should be performed in such a way that biotic resources are preserved or improved. The Management Guidelines and Planned Actions deal with these issues as well.

Finally, input has been received regarding the desire for details on exactly how SDSF will manage and maintain its biotic resources. Since this management plan is intended to be general, specific information on the what, how, why, and when of SDSF management activities will be outlined at a different time. More specific management strategies will be developed for different areas and habitats based on anticipated management endeavors and research and monitoring results.

MANAGEMENT GUIDELINES

1. Although no threatened or endangered species have been confirmed to occur in SDSF, ongoing monitoring will be performed to detect special status species. Monitoring will include keeping current with state and federal lists as well as conducting periodic floral and faunal surveys. Inventories will emphasize special-status species expected to be present but not yet observed in SDSF. New findings will be added to current species lists. Every consideration will be given to protecting these species and their habitat as required by law and determined by a qualified biologist.
2. Old-growth trees will be protected as outlined in SDSF's authorizing legislation, AB 1965. Areas of old-growth

Table 2. Special-status wildlife species with potential to occur at Soquel Demonstration State Forest.

SPECIES	LEGAL STATUS ^a FEDERAL/STATE ASSOCIATION	HABITAT	OCCURRENCE IN SDSF ^b
Marbled murrelet	T/E	Nests in old-growth conifer forest; forages in pelagic habitats	4
Golden eagle	--/CSC	Nests in cliffs and trees in forests and woodlands; forages in grasslands, shrublands, and chaparral	2
Cooper's hawk	--/CSC	Nests and forages in woodlands and forests; also forages in open habitats	2
Sharp-shinned hawk	--/CSC	Nests and forages in conifer forest habitats	1
Long-eared owl	--/CSC	Nests and forages in riparian and woodland habitats	4
Purple martin	--/CSC	Nests and forages in woodland and forest habitats	4
Yellow warbler	--/CSC	Nests and forages in riparian habitats	4
Foothill yellow-legged frog	C2/CSC	Occurs in streams with rocky substrate	1
California red-legged frog	T/CSC	Occurs in slow-moving streams, pools and ponds	2
Southwestern pond turtle	C1/CSC	Occurs in pools, ponds, and lakes	2

^aStatus codes:

Federal

- T = threatened.
- E = endangered.
- P = proposed for listing as threatened or endangered.
- C1 = Category 1 candidate for listing as threatened or endangered.
- C2 = Category 2 candidate for listing as threatened or endangered.

State

- CSC = species of special concern.
- T = threatened.
- E = endangered.

^bOccurrence numbers:

- 1 = confirmed nesting/reproduction.
- 2 = observed.
- 3 = not observed.
- 4 = unlikely to occur.

Source: Jones and Stokes Associates, Inc., 1996

redwood have been located and protection will be provided in all phases of forest management. Additionally, areas have been designated to promote late-succession stands of trees (see the Timber Management chapter for more details).

3. Restore, maintain, or enhance resource values of native habitat communities to promote natural diversity and stability. Measures to achieve this include:
 - * snag recruitment and retention
 - * preservation of appropriate logs and other woody debris
 - * maintenance of natural ponds and springs
 - * protection of riparian zones for use as movement corridors for wildlife
4. Achieve mutual benefit with timber harvesting, demonstration and education, and recreation programs while respecting native biotic elements. Wildlife habitat improvements, such as those mentioned in Management Guideline 3 above, will be considered during the planning and implementation of timber sales, demonstration and education activities, and recreational facilities. Conversely, possible impacts of present or future wildlife and vegetation management projects on other management objectives will be studied prior to project approval and implementation.
5. Control or eradication of exotic plant species will be incorporated into management activities, as appropriate. Ben Lomond Youth Conservation Camp crews, California Conservation Corps members, and volunteers will help with the removal of exotics whenever possible.
6. Control mushroom collection by issuing permits for scientific, educational, and personal use. Mushroom gathering for commercial purposes will be prohibited.

PLANNED ACTIONS

1. Develop a detailed wildlife plan that focuses on the needs of SDSF's biotic community. The plan will provide for habitat and population assessments, management recommendations, and monitoring techniques. Recommendations from the Preliminary Biological Assessment of Soquel Demonstration Forest, Santa Cruz County, California (Holland et al., 1992) will be incorporated as appropriate along with information from CDF, California Department of Fish and Game, and local biologists.
2. Work with computer databases for long-range planning. The Wildlife Habitat Relationships (WHR) and Natural Diversity Database (NDDDB) systems will be examined and incorporated into the planning process.

3. Conduct preharvest surveys to identify active nest sites of all special-status bird species that may occur in the Forest. Those species that may occur in SDSF are Cooper's hawk, sharp-shinned hawk, long-eared owl, and yellow warbler. In addition, preharvest surveys will be conducted for California red-legged frog, foothill yellow-legged frog, and southwestern pond turtle.
4. Evaluate the feral pig situation, and develop management strategies and actions to diminish existing problems.

FISHERIES

INTRODUCTION

Approximately 8 miles of fish-bearing streams flow through SDSF, including the East Branch of Soquel Creek (5.5 miles), Amaya Creek (2 miles), and Fern Gulch Creek (0.5 miles). The East Branch is one of the few remaining steelhead trout spawning and rearing areas in the county. This, along with their cultural values, makes the fisheries of SDSF an important resource.

STEELHEAD TROUT AND COHO SALMON

The fishery resources of greatest concern in SDSF are the steelhead trout and coho salmon. Anadromous fish such as steelhead and coho spawn (mate and lay eggs) in creeks or rivers but spend most of their adult lives in the ocean.

The cycle begins with the development of eggs into young fish in streams where the adults spawned. Once the eggs hatch, young fish develop in the watercourse and gradually make their way to the ocean. Steelhead trout in this area typically spend their first year in fresh water although a few may spend two or three years inland before migrating. The length of time spent in streams depends on environmental and genetic factors, and some individuals may never migrate at all (Barnhart, 1986). Coho salmon spend one year in freshwater before going to the ocean. Due to the abundance of food, anadromous fish species experience most of their growth once they have reached the ocean. Steelhead and coho along the California coast usually spend two years in salt water, attaining sexual maturity and storing fat for their journey back up streams. As with all anadromous fish, steelhead trout and coho salmon usually return to the stream from which they hatched to mate and lay eggs. Coho die following spawning, but steelhead swim back to the ocean. Steelhead may repeat the cycle and spawn up to four times, but most repeat spawners do so only twice.

Historically, steelhead trout and coho salmon spawned in coastal streams from the Bering Sea of the Arctic and the coast of Japan to the Monterey Bay in California. The steelhead's range extends further to the north coast of Baja California. Steelhead and coho populations have been declining throughout their entire range, both in fresh and salt water, for decades due to a number of factors including habitat loss. In California, numbers decrease from north to south, with the southernmost population of steelhead in the Ventura River (Barnhart, 1986), and coho in Scott Creek. The Soquel Creek watershed is within the steelhead and coho's range but, as discussed below, has met with a considerable decline in numbers.

LOCAL FISH POPULATIONS

Anadromous fish populations in Soquel Creek and along most of the Central Coast have declined significantly since the late 1960's. According to Dave Hope, resource planner for the County of Santa Cruz, past steelhead runs in Soquel Creek may have had up to 1,000 fish, while today runs are estimated to be no more than 100. (Runs are groups of fish that swim upstream around the same time of year to spawn.) Steelhead has been proposed for listing as endangered under the federal Endangered Species Act.

Coho salmon were also historically present in Soquel Creek and reports estimate that runs included from one to two hundred fish. Over the last 30 years, however, the coho population of Soquel Creek has vanished with the last known run in 1968 (Anderson, 1995). On November 6, 1995, the coho salmon was listed as threatened in waters south of San Francisco Bay under the California Endangered Species Act. It was also listed on December 30, 1996 as threatened under the federal Endangered Species Act as far south as the San Lorenzo River.

Other species of fish within the boundaries of SDSF include the Pacific lamprey and a small resident rainbow trout population above Ashbury Gulch. According to biologist Jerry Smith, additional species likely to be found in the East Branch include prickly sculpin, coast range sculpin, California roach, Sacramento sucker, and northern threespined stickleback.

In order to help protect remaining steelhead trout populations in Soquel Creek, the California Department of Fish and Game prohibits angling in the East Branch of Soquel Creek (Fish and Game South Central District Regulation, Title 14, Section 7.00 [e] [4]). This regulation was adopted by the California Fish and Game Commission in December of 1981 and became effective in March, 1982. In spite of this regulation, poaching of adult steelhead during winter spawning is prevalent and continues to affect fish populations. To avoid adverse impacts of public use on fish in SDSF, forest staff and the California Department of Fish and Game will conduct ongoing patrols to enforce prohibitions on fishing and fish harassment.

The most recent planting of hatchery-raised steelhead in SDSF (i.e., the East Branch of Soquel Creek) occurred in the 1930's. According to Matt McCaslin of the Monterey Bay Salmon and Trout Project (MBSTP), steelhead trout from the Brookdale and Big Creek hatcheries were released in the East Branch at that time. Coho salmon planting also occurred in the 1930's from the Brookdale, Big Creek, Prairie Creek, and Fort Seward hatcheries (Anderson, 1995). Currently, the MBSTP stocks steelhead annually in the main stem of Soquel Creek (downstream of the Forest) and, in the early 1980's, released fish near the quarry (just south of the Forest).

HABITAT AND RESOURCE CONSIDERATIONS

HABITAT ATTRIBUTES

The basic stream attributes for steelhead and coho spawning, rearing, and migration include cool water temperature, high concentrations of dissolved oxygen, adequate water depth, sufficient pool space, and low sediment levels (Barnhart, 1986 and Anderson, 1995). In addition, suitable hiding cover, food supplies, and access to spawning areas can influence the survival of steelhead and coho. All of these habitat conditions need to be considered when working to restore, maintain, or enhance anadromous populations.

Riparian zones are strips of water-loving vegetation and associated organisms that follow the path of watercourses. Essential to healthy aquatic ecosystems, these zones help maintain favorable water quality and provide important food and habitat conditions. Trees along the water's edge shade the water, maintaining cool temperatures for anadromous fish spawning and rearing. Riparian vegetation also stabilizes streambanks and intercepts eroded materials from upslope, minimizing the amount of sediment that enters the stream. Additionally, vegetation adds food and nutrients to the water for use by aquatic invertebrates. Large woody debris falling into the water provides cover for fish, collects and controls the movement of sediment, and creates pools. Conifers will be planted in riparian zones, in areas where none exist, to promote long-term recruitment of large instream woody debris. Small intertwined pieces of debris, such as branches and twigs, act as collectors of leaf litter and provide more food for invertebrates.

HABITAT LOSS AND DEGRADATION

The loss of habitat, particularly that for rearing, has had a significant impact on the anadromous fish populations of the Soquel Creek drainage. Habitat has declined due to diversion and overdrafting of water by residents, past logging practices, flood control measures, increased development along the creek (including vegetation removal), pollution, and naturally unstable hillslopes. These elements have increased water temperature, added sediment to the creek, altered natural flow patterns, and decreased water levels during the critical summer months and periods of drought. (See the Watershed Assessment chapter for details on SDSF's watercourse conditions.)

Over the years, the combination of increased sediment and lowered water levels have resulted in a considerable loss of pool space throughout the Soquel Creek watershed. This loss of pool space, along with general fresh and saltwater habitat degradation, may have contributed to the disappearance of the coho salmon. Coho population densities along the central coast are extremely low and would need vast assistance and human cooperation to become viable again.

An additional habitat problem in the East Branch involves access to spawning areas. A few log jams within SDSF may not be passable by fish. During periods of high water, fish may be able to overcome these barriers, but conclusive evidence of this does not exist. Careful study and evaluation of the steelhead population and barriers may reveal ways to improve steelhead access. Log jams and other barriers will not be removed unless it is evident that such removal will do more good than harm. Furthermore, removal of log jams would be reviewed and approved by the California Department of Fish and Game.

The diversion and overdrafting of water are significant problems in the Soquel Creek drainage, especially along its lower reaches. Near the town of Soquel, a portion of the creek has dried up on various occasions, including the summers of 1991, 1992, and 1994. Some residents along the creek use the water for agricultural as well as domestic needs. There are water allotment requirements, but the requirements of fish were not considered when maximum amounts for residences and businesses were allocated. Because young steelhead move downstream as upper portions of streams dry out in the summer, additional drying downstream limits available space and foraging areas for the entire population.

Greater public awareness and response regarding the aquatic resources of the Soquel drainage are essential for maintaining a healthy anadromous population. Residents need to conserve water, allow the creek to flow its natural path, preserve riparian corridors, and prevent accelerated erosion. While improving the anadromous fish resource within SDSF is a start, it is not enough: Soquel Creek's fisheries require good habitat conditions along every reach of the watercourse and throughout the watershed. All creek users and neighbors should consider the consequences of their actions and how they can help improve the resource.

MONITORING AND ENHANCEMENT

Fish habitat at SDSF will be enhanced through monitoring of fish populations and their habitat, and implementation of habitat enhancement projects in conjunction with ongoing timber operations. This ongoing inventory, which began in 1993, will provide information needed to identify goals and objectives and result in a Fisheries Management Plan. Potential habitat enhancement sites will be identified and mapped. Proposed enhancement structures will be reviewed and approved by the California Department of Fish and Game and a qualified hydrologist before installation. To evaluate the success of enhancement activities, regular monitoring will check levels of effectiveness. If any structure is functioning improperly or is adversely affecting aquatic habitat, forest staff will redesign, repair, or remove the structure, as needed.

AQUATIC INVERTEBRATES

Aquatic invertebrates are organisms with external skeletons that live in water. They include insects (e.g., mayflies), crustaceans (e.g., crayfish), mollusks (e.g., snails), and freshwater earthworms. An important component of aquatic ecosystems, aquatic invertebrates are an essential part of the food web. They typically act as indicator species of fishery habitat quality and water pollution.

When tree litter falls into the water, microorganisms such as bacteria colonize and decompose the material, creating a slime substance. This substance becomes food for invertebrates, which in turn become food for fish. In this way, aquatic invertebrates provide a link in the food chain between microorganisms and fish, a connection crucial to fish survival.

In fresh water such as the East Branch, juvenile steelhead feed primarily on immature, aquatic stages of insects but will also feed on adult terrestrial insects (Barnhart, 1986). Steelhead prefer the larvae of mayflies, true flies (e.g., gnats), and caddisflies. They are often opportunistic, however, and may feed on any available insect. Adult steelhead typically do not eat during migration and spawning, instead obtaining energy from fat accumulated while living in the ocean.

Because they function as food, aquatic invertebrates, particularly insects, are key indicators of good fish habitat. In most cases, large amounts and diverse species of aquatic invertebrates signify an adequate food supply, increasing the ability of the stream to support larger and healthier populations of fish. Similarly, invertebrates need adequate amounts of leaf litter falling into the stream (therefore, adequate riparian vegetation) and appropriate conditions to support the microorganisms which convert the litter to a usable form. Because of their specific roles and narrow habitat requirements, invertebrates are useful indicators of stream conditions and changes. Through inventory and monitoring the composition of aquatic invertebrate communities, the health of aquatic ecosystems can be carefully evaluated. The first inventory occurred in October, 1995. Monitoring will continue on a regular basis.

PUBLIC COMMENTS AND CONCERNS

Comments and concerns regarding the aquatic resources of Soquel Creek were numerous and often fervid. Given the condition of California's steelhead resource and the significance of the Soquel Creek watershed, one would expect a great concern for its future. The comments, concerns, and suggestions received as a result of this concern are represented by two major categories.

The first and probably most important concern involves the maintenance and enhancement of fisheries and other aquatic

resources within SDSF. Individuals have stated that, at the very least, SDSF should maintain the resources as they currently exist. Additionally, suggestions for improving the habitat and, therefore, the steelhead fishery touched on in-stream improvements and careful logging methods. SDSF will assuredly work to enhance all wildlife resources and habitats, including those of steelhead.

The second category of concern is really an extension of the first. Comments related that, in order to maintain and enhance SDSF's aquatic resources, inventories and monitoring of these resources must be performed. Specifically, commentators expressed that biologists familiar with the Soquel Creek watershed set up and maintain a monitoring system which tracks the effects of SDSF's management activities on the resource. Strategies to ensure maintenance and enhancement of aquatic organisms could in turn be developed from the results of inventory and monitoring activities. SDSF plans to conduct the activities mentioned above as well as research and habitat improvement in order to satisfy these concerns (see Planned Actions below).

MANAGEMENT GUIDELINES

1. Protect stream channels, streambanks, and riparian zones during all management activities. Late-succession management areas (see the Timber Management chapter) have been established along all fish-bearing streams and receive specialized management designed to enhance the riparian zone. This will ensure protection of stream integrity, including the channel, bank, and vegetation as well as fisheries resources.
2. Increase the fisheries potential by improving the spawning and rearing conditions of the East Branch of Soquel Creek within SDSF. Methods for improvement will be identified by the assessment discussed above but may encompass actions such as sediment reduction, barrier removal, and pool creation.
3. Demonstrate that other forest management activities are compatible with the maintenance of healthy fisheries populations and habitats. For example, educational displays will be used in recreation areas to inform visitors of the need to practice special care along watercourses. Also, tours of harvested areas could show standard and advanced erosion control techniques utilized to reduce impacts on watercourses.
4. Help residents of the East Branch watershed learn about the components of a healthy watershed and the importance of its maintenance. Educational programs, either formal or informal, will focus on stream health, riparian zones, and the impacts of human use. Once established, the Forestry

Education Center (refer to the Demonstration and Education chapter) will likely be the setting for these programs, allowing residents and other interested individuals to learn about the significance of aquatic ecosystems.

PLANNED ACTIONS

1. Complete a fisheries resources assessment and develop a Fisheries Management Plan by December 31, 1998. The assessment will inventory the condition of the fisheries population as well as habitat status within SDSF. The management plan generated from the results will include prioritized improvements, monitoring systems, research opportunities, and funding sources. (Refer to Appendix C, Monitoring Plan.)
2. Provide additional aquatic ecosystem research opportunities in the East Branch and its tributaries. Likely subjects for examination include fisheries populations and habitat, aquatic invertebrate communities, and riparian zone studies. Research opportunities for local high school or college students will be emphasized but professional research will not be discouraged.
3. Coordinate with the County of Santa Cruz and other groups to complete habitat restoration and maintenance projects. Private groups such as the Monterey Bay Salmon and Trout Project or crews from the Ben Lomond Youth Conservation Camp may help with projects such as channel stabilization, hiding cover retention, riparian vegetation maintenance, pool creation, and barrier removal.
4. Continue fish sampling in Amaya Creek and the East Branch of Soquel Creek. Electrofishing will be the primary method but other procedures such as underwater observation may be incorporated. Fish will be evaluated for species, size, health, and location. (Refer to Appendix C, Monitoring Plan.)
5. Conduct aquatic habitat surveys at least once every ten years in accordance with the California Department of Fish and Game methodologies. Monitor ecological condition of aquatic habitats by sampling invertebrates using the protocol developed by the U.S. Environmental Protection Agency in cooperation with the California Department of Fish and Game. (Refer to Appendix C, Monitoring Plan.)
6. Fish habitat enhancement structures will be reviewed and approved by the California Department of Fish and Game and a qualified hydrologist before installation. The removal of fish barriers will be reviewed and approved by the California Department of Fish and Game. Where possible, logging equipment will be utilized to assist in barrier removal and enhancement structure development. (Refer to Appendix C, Monitoring Plan.)

7. Conduct ongoing patrols with the assistance of the California Department of Fish and Game to enforce prohibitions on fish poaching and harassment. Incidents will be recorded, compiled, and evaluated annually to determine significant adverse effects on SDSF fisheries. (Refer to Appendix C, Monitoring Plan.)

DEMONSTRATION AND EDUCATION

INTRODUCTION

As stated in the Timber Management chapter, a goal of SDSF is to demonstrate sustained-yield timber production with innovative forest management practices within the context of local community protection, and subject to the limitation of commercial timber harvesting provided in the legislation (PRC 4660-4664). The intent of this goal is to encourage conscientious forestry practices on private lands and demonstrate these practices to the surrounding urban populations. This can lead to improved attitudes toward our natural resources and forestry in general, enhancing responsible stewardship of our forest lands.

Another goal is to show forest visitors that timber management, forestry education, public recreation, and environmental protection are interrelated and compatible. This will be accomplished through combinations of these programs whenever possible. SDSF's location is well suited for the development of forestry education programs because it is close to schools in both the Monterey and south San Francisco Bay areas. This proximity is ideal for groups to learn the importance of forest ecology and management. Similarly, it offers local landowners and the general public an opportunity to view the protection, management, and utilization of renewable natural resources. Field trips would involve public motor vehicle use.

The Demonstration and Education Programs of SDSF will rely on interpretation, volunteer participation, and the creation of an educational center. Each of these elements, as well as the Demonstration and Education Programs themselves, are outlined in the following paragraphs.

DEMONSTRATION PROGRAM

OVERVIEW

The Demonstration Program is a major focus of SDSF for a number of reasons. Most importantly, it provides an opportunity for the general public and educational groups to observe an active working forest. Forestry demonstration can assist the public in understanding forest management and its role in resource conservation and local economics. Additionally, it reminds us of the many wood products we use daily and the importance of keeping forests healthy and productive. Knowledge such as this can help change the negative public image generally associated with forest management practices. Also, the demonstration of various forest activities can potentially benefit small private landowners in the management, protection, and enhancement of their forest lands.

The opportunity for demonstration projects will increase as SDSF becomes better established. The staff will remain aware of the demonstration potential at the onset of new activities. Demonstration projects may be short term, with several topics addressed each year, or long term, extending over many years.

The primary consideration of the Demonstration Program is to enhance the public's understanding and awareness of forest management principles and techniques consistent with environmental protection. Throughout the process of establishing projects, a strong emphasis will be placed on environmental protection. The following are demonstration opportunities at SDSF:

Silvicultural Systems	Erosion Control
Tractor/Cable Harvesting Operations	Hardwood Management
Disease and Insect Management	Growth and Yield
Recreation Management	Riparian Management
Reforestation Methods	Cumulative Effects
Fisheries Protection/Enhancement	Fuelwood Management
Road Construction/Maintenance	Prescribed Burning
Old-Growth Redwood Protection	Habitat Enhancement
Watershed Protection	Fire Protection

PLANNED ACTIONS

1. Demonstrate forest management practices and ecosystem enhancement techniques. To accomplish this, incorporate an identifiable demonstration feature in timber sale planning and implementation, recreation designs and development, or other forest management activities, as appropriate.
2. Develop and implement outreach programs to contact the general public, school groups, and private landowners for demonstrational opportunities. Encourage visits and tours by interested public groups, individuals, schools, and professional organizations.
3. Establish a safe and efficient method of displaying information from or conducting tours of demonstration projects. Displays should be made available and tours held at times that encourage forest user group's attendance and participation (e.g., summer weekends, evenings).

FORESTRY EDUCATION

OVERVIEW

The results of SDSF's Recreation Study indicate an encouraging level of interest in the Forest's education potential. In order to intensify this interest, SDSF's Forestry Education Program will be informative and fun, providing as many hands-on experiences as possible. The program will be applied in

conjunction with demonstration objectives and occur in many different forms. Forestry education will introduce various target groups to progressive forest management practices, resource protection, logging history, forest ecology, and research. This will be accomplished through literature, indoor presentations, and outdoor programs.

Instructional organizations can learn about SDSF's resources by sponsoring classroom presentations or bringing groups to the Forest. School programs may represent a theme, such as Arbor Day or Earth Day, and include activities both at school and SDSF. Classroom and outdoor presentations might also be subject oriented with topics such as watershed management, forest ecology, soil biology, or wildlife found in the Forest.

An educator training program, similar to the one at Elkhorn Slough Reserve, will provide the means for teachers and their students to experience forestry education without relying on Forest staff. A program such as this will offer workshops for educators on different aspects of SDSF and forest resources in general. After completing training, educators may bring their students to the Forest for non-staffed instructional field trips. This removes the time burden from Forest staff members while allowing instructors to absorb new information and reinforce their own training.

Information for the general public and small private landowners will be disseminated through tours, newsletters, brochures, workshops, and seminars. Newsletters and brochures may cover information such as current events, research projects, or compatible rural land uses. Workshops will provide opportunities to learn about forest management techniques and how to solve problems in a group setting. Finally, seminars will focus on specific topics as well as the presentation of ideas, research results, and group discussion.

PLANNED ACTIONS

1. Develop educational information and programs related to forest management and ecosystem processes. Presentations suitable for groups which include people of diverse backgrounds and varying ages as well as group-specific programs will be developed.
2. Determine the best method to distribute information about the forest resources of SDSF to different user groups. Methods to present facts about SDSF may include oral presentations, written information, and interpretive facilities.
3. Encourage educational organizations, such as local public schools, to use the Forestry Education Program. Stimulate participation by offering quality educational experiences that are both informative and enjoyable. SDSF should establish working relationships with educators and their students.

4. Develop a teacher training program that will allow educators to lead their own forestry education programs. Offer workshops on topics such as forest ecology, wildlife habitat requirements, and watershed dynamics which apply directly to SDSF. The training procedure should encourage on-going programs which allow students to work with SDSF over a period of time.

INTERPRETATION

OVERVIEW

The public can gather information about SDSF in a variety of ways while visiting the Forest. Interpretive facilities such as self-guided trails, information boards, and hands-on activities offer the Forest visitor an opportunity to learn the many features of SDSF. Since groups who utilize the Forest differ in their use of its many resources, information that applies to and interests many different individuals is essential. Interpretive facilities are a great way for the staff to meet the important goals of public demonstration and education without being relied upon for instruction.

INTERPRETIVE OPPORTUNITIES

Self-guided walking tours incorporate designated stops that are marked and indicated in a guide book. Stops on trails in SDSF might focus on unique sites and vegetation of the Forest or provide activities that facilitate learning. Interpretive trails will work well in SDSF because hiking is a common activity. The Forest provides many possibilities for educational trails, including a number of old logging trails and roads.

Information boards are effective tools that offer educational and operational information. Boards located at parking areas, popular recreation sites, trail heads, and along trails will provide information in the form of displays and brochures. Facts that relate to general forest news are best suited to this type of interpretive facility, and will include subjects like riparian protection, current logging practices, or forest ecology.

Hands-on activities with touchable items and sensory-oriented exercises for adults and children are another form of forestry education. These activities will either stand alone or be coordinated with self-guided and staff-led tours. For example, a touchable tree round on a self-guided trail may help visitors understand how tree age is determined or how human history compares to that of a tree. Forestry tools such as clinometers or diameter tapes could be used to show visitors how trees are measured. Areas containing hands-on activities should be located near popular recreation sites, picnic areas, and parking areas.

Staff-lead tours will travel over expansive areas not covered by self-guided trails and contain stops that are not visibly marked.

Guidebooks and hands-on activities may accompany tours, with staff members offering supplemental information.

PLANNED ACTIONS

1. Coordinate planning of interpretive facilities with all forest activities, including recreational use, demonstration projects, resource protection, and timber harvesting. Install interpretive facilities near popular recreation sites, parking locations, and areas receiving silvicultural, enhancement, or restoration treatments.
2. Develop an interpretive plan that addresses the SDSF educational audience, types, numbers, and locations of potential interpretive facilities, and the subject matter to be presented. The plan should also include recommendations for facility development as well as monitoring of facility use.

VOLUNTEER PROGRAM

OVERVIEW

A volunteer program will be used to assist the small Forest staff in several ways including efforts to provide a complete and comprehensive forestry interpretive program. Docents are volunteers who have an interest in both the SDSF and natural resources in general and enjoy sharing their experiences with others.

SDSF's docents will be available for public contact and interpretation in both the Forest and educational settings (such as classrooms). In the field, docents will benefit the Forest by providing visitors with information on current events, facilities, vegetation and wildlife, cultural history, and rules and regulations. Ideally, volunteers will have training in first aid and be able to radio for help during emergencies.

Volunteers will also assist in research and monitoring programs, and maintenance and construction projects. The individual skills and talents of SDSF's volunteers, such as knowledge of local flora and fauna, leadership and interpretive skills, and experience working with people, will be utilized to support the Forest. Through their work, volunteers will both benefit the operation of SDSF and acquire a better appreciation of state forests and natural resources in general.

PLANNED ACTIONS

1. Develop a volunteer program which includes docent recruitment. Volunteers will lead tours, patrol the Forest, and assist with education, research, and monitoring programs.

2. Provide training to familiarize volunteers with the history of the state forest system, SDSF's history and objectives, rules and regulations, patrol procedures, and interpretive skills. General training will also include more specific information relating to SDSF's access routes, vegetation, wildlife, and research and monitoring objectives.

FORESTRY EDUCATION CENTER

OVERVIEW

If created, the Forestry Education Center (FEC) will be the focal point of SDSF. It could house the forest headquarters, staff offices, an interpretive center for forest visitors, and a meeting place for demonstration and educational tours. The FEC may also house a resource library, research laboratory, overnight accommodations, and an auditorium. The auditorium, useful for both administrative and educational purposes, could serve as a location for meetings, classes and workshops, seminars, informational slide shows, and videos.

The FEC will be used to present a range of information about SDSF's resources including maps, self-guided tour booklets, announcements of current events and management activities, sign-ups for demonstration tours, and fire prevention information. Examples of interpretive exhibits and displays available through the FEC include:

Logging History/Equipment
Silvicultural Systems
Wood Products
Water Use
Fire Safe Program

Herbarium
Tree Physiology
Wildlife
Soil Information
Fisheries

PLANNED ACTIONS

1. Develop site selection criteria for the FEC based on expected use, cost, building size, and exhibit development. Select and acquire, if possible, an appropriate location for the FEC based on the above criteria as well as proximity to the State Forest and accessibility by the general public.
2. Determine specifically how the FEC will be used. Conduct subsequent environmental documentation under CEQA. Design and build the facility, including outside grounds, so that expected use can be accommodated. Expansion and improvement of the center in the future should also be taken into consideration during initial planning.
3. Plan and develop public education exhibits which meet forestry demonstration and education objectives yet remain interesting and fun for all age groups. Encourage rotating presentations from local schools or special interest groups as well as permanent displays.

4. Seek alternative funding sources as contributions toward development and operation of the FEC. Supplemental funding from grants and private donations may be used for interpretive presentations, display development, and facility improvements.

PUBLIC COMMENTS AND CONCERNS

Public comments and concerns relating to forestry demonstration and education have conveyed much enthusiasm. Respondents to the recreation study (see the Recreation chapter) indicated excitement about the potential opportunities to view and learn about the workings of a forest such as SDSF. Additionally, comments about the FEC and demonstration goals express an interest in the facilities and methods through which demonstration and education will take place.

Forest neighbors and users have indicated curiosity in the future of the FEC, specifically its location and proximity to the Forest. Since the actual development of the FEC has yet to be determined, its location and accessibility remain undecided. Time and finances permitting, SDSF plans to carefully select and acquire a piece of property well-suited to everyone's needs.

TIMBER MANAGEMENT

INTRODUCTION

The main purpose of SDSF's timber management and harvest program is to conduct demonstrations, education, and research in forest management, including sustained-yield management with examples of timber harvesting, that ensures proper land stewardship, improved forest health, and protects and preserves SDSF as an intensively managed, multifaceted research forest, consistent with the legislative goals of PRC Sections 4660-4664.

As stated above, a major purpose of the SDSF timber management program is to demonstrate sustained-yield management with examples of timber harvesting. In simple terms, sustained-yield is the yield of commercial wood that an ownership can produce continuously at a given intensity of management consistent with required environmental protection and which is professionally planned to achieve, over time, a balance between growth and harvest. For SDSF, this plan provides for harvest levels well below the level of growth. SDSF is to be used to demonstrate examples of timber harvesting under sustained yield management while also sustaining or improving air, fish and wildlife, water resources, watersheds, aesthetic values, and recreation. Silvicultural methods and harvest techniques that can be applied under California Forest Practice Rules for the southern sub-district of the Coast Forest District will be researched and utilized to demonstrate sustained-yield management with an uneven-aged forest structure.

The harvesting of timber will comply with the discussion found in the Funding and Taxes section of the Administration Chapter. A secondary goal of harvesting timber is to generate revenue to cover maintenance, operation, and other costs of SDSF. This includes funds needed for research, inventory, monitoring, and rehabilitation projects of the various resources in SDSF. It is not likely that revenues will meet expenditures, even at the current minimum level of expenditures, during the initial ten-year period of this plan. It is anticipated that revenues and expenditures will converge in approximately the fifth decade of operations. Specific revenue projections are not made because of the inherent uncertainty of timber values and markets. Annual harvest levels may need to be adjusted from time to time to reflect physical conditions in the SDSF, such as catastrophic events. If a significant drop in timber prices occurs, timber harvesting will not exceed the limits discussed in the Harvest Plan section of this chapter. The Department will attempt to maintain basic operation and maintenance services from the FRIF fund in line with other State Forests.

HARVEST HISTORY

The first timber harvesting in SDSF occurred during the late 1800's when the Forest was part of land owned by F. A. Hihn (see the Property Description chapter for a more detailed account of the history of ownership). Hihn logged old-growth redwood along portions of Amaya Creek and his private Sulphur Springs Road. Upon his death in 1913, Hihn's heirs assumed ownership of his lands and continued limited old-growth redwood and tanoak removal.

In 1924, the property was sold to the Monterey Bay Redwood Company (MBRC). The MBRC harvested approximately 100 million board feet of old-growth redwood from 1926 to 1942. Between 1926 and 1934, logs were yarded to roads using ground lead cable systems powered by steam donkeys. Logs were taken to the millpond, located south of Olive Springs, on trailers towed by tractors. From 1934 to 1942, logs were yarded by tractor and transferred to the mill by log trucks.

The MBRC sold their property to Glenco Forest Products, later known as the CHY Company, in 1961. During their ownership of the SDSF property, CHY performed a small amount of selective timber harvesting between the Sulphur Springs area and the eastern boundary.

In 1979, the Pelican Timber Company purchased a portion of CHY's land, including what is now SDSF, and prepared extensive harvest plans. Pelicans's Timber Harvest Plans were strongly opposed and, after court battles, expired before large amounts of timber were removed. Pelican did actually harvest a small amount, though, prior to state acquisition of the property. Approximately 15 acres of hardwoods in the Sulphur Springs area and 230 acres of second-growth redwood and hardwoods along the west boundary were selectively harvested between 1979 and 1984.

CONIFER VOLUME INVENTORY

There have been three known timber inventories completed for the SDSF property since the turn of the century. The first inventory was completed in 1916 preceding significant harvest of the area. Timber cruisers from San Francisco were hired prior to logging to determine where to locate mills and the best method of transporting logs to those mills. They also judged how much lumber they could harvest from a particular area. The timber cruisers estimated an average volume of 37,300 board feet per acre for the property that is now SDSF, the majority of which was old-growth redwood.

The second inventory was completed in 1978 for Harwood Products, a potential buyer of the property, to ascertain timber growth and volume. Average stand age was approximated to be anywhere from 30 to 90 years old. The average volume per acre for the SDSF portion of the property was estimated at 13,600 board feet, 90 percent of which was redwood.

The third inventory was conducted by SDSF staff in the summer of 1991. The goals of this variable-radius inventory were to establish current volume and basal area by species and to acquire information on species distribution. Table 3 contains the results for volume and basal area of commercial conifers. Based on harvest history, the average age of most forest stands was estimated to be 65 years old.

A new, more detailed inventory is needed for harvest scheduling and Wildlife Habitat Relationships (WHR) classification analysis. Resources permitting, the inventory will be designed for use by the year 2000. Data collected will focus on different forest types rather than the Forest as a whole. The sampling design may include both permanent and temporary data collection points as well as variable and fixed radius plots.

Table 3. SDSF conifer basal area and volume estimates.*

SPECIES	PER ACRE		FOREST-WIDE TOTAL VOLUME (board feet)
	BASAL AREA (sq. ft.)	VOLUME (board feet)	
Redwood	138	22,033	59,070,473
Douglas-fir	35	6,817	18,276,377
Both Species	173	28,850	77,346,850

* Basal area, the horizontal cross section of trees measured at four-and-one-half feet above ground, is a measure of forest stocking or density. Volume is measured in board feet; a board foot is a unit of measure one foot by one foot by one inch.

A timber type map for the Forest was created in 1979 by Hammon, Jensen, Wallen, and Associates, a private forestry consulting firm. This map shows homogenous areas based on species, structure (e.g., old growth vs young growth), and density of forest cover. Though the map is functional, the creation of a more inclusive representation of the Forest is necessary. This can be accomplished by a new forest map that includes tree species, structure, and density and WHR classifications.

CONIFER GROWTH AND YIELD

A conifer growth study based on the 1991 inventory was done in the first quarter of 1993. A sample of merchantable (greater than 12 inches DBH [DBH represents tree diameter 4.5 feet off the ground on the uphill side]) and submerchantable (less than 12 inches DBH) trees was used to predict growth over a ten-year period. Submerchantable trees are expected to become merchantable during this ten-year growing period. The results indicate the Forest is growing an average of three percent per year. Table 4 illustrates projected annual growth on a per acre basis and forest wide totals for redwood and Douglas-fir.

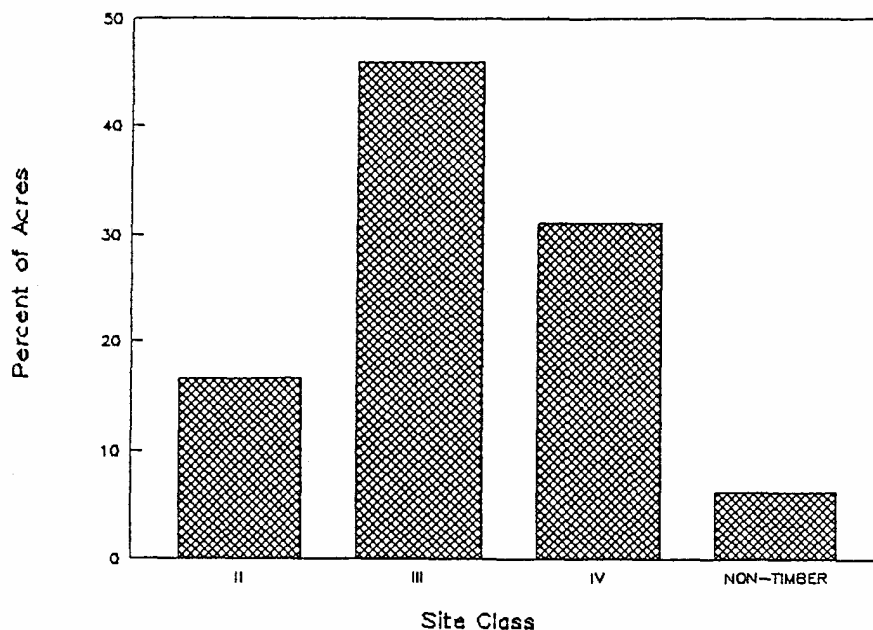
Table 4. Annual growth estimates for SDSF's redwood and Douglas-fir.

SPECIES	PER ACRE GROWTH (board feet)	FOREST-WIDE TOTAL GROWTH (board feet)
Redwood	713	1,910,481
Douglas-fir	260	696,256
Both Species	973	2,606,737

SITE QUALITY

Timber site quality information for the Forest comes from the Soil Survey of Santa Cruz County (SCS, 1980). Figure 4 depicts the percentage of acres from each site class in the Forest. Site classifications range from I to V, site I being the best for timber production. As the graph displays, the most prevalent site class is III (1233 acres), followed by site IV (833 acres), and site II (445 acres). Included in the graph are areas which were not classified as timber production land (170 acres); most of these areas correspond to creekbeds and grasslands. There are no areas containing site classes I or V in the Forest.

Figure 4. Timber site quality for SDSF.



SILVICULTURE

FOREST DESCRIPTION

Areas in SDSF eligible for harvest include coast redwood and mixed evergreen (Douglas-fir and hardwood) forest communities. Hardwoods, especially tanoak, are a large component of both communities. The normal process in forest succession is for conifers to overtop and suppress hardwoods, as is presently occurring in SDSF. This event will ultimately move the Forest through its current mid-successional stage into a late-successional condition. The 65-year-old forest is reasonably healthy though overcrowded in some areas (too many trees in any one location). SDSF will research and demonstrate ways to improve forest structure and vigor through timber harvest.

The diameter distribution (tree diameter class plotted against the number of trees per acre) of SDSF resembles a traditional uneven-aged forest even though the forest is really a young, even-aged stand (Figure 5). Uneven-aged forests contain many diameter classes and at least three age classes. These forests are typically managed on a size and structure basis. Even-aged forests contain one to two age classes of trees and are managed according to age.

The diameter class distribution of a truly uneven-aged forest forms an inverse J-shaped curve, indicating decreasing numbers of trees as diameter increases. Smaller diameter classes commonly represent younger trees; the number of those smaller trees which mature into larger and, theoretically, older trees then decreases through time, as the curve shape implies. Having a greater

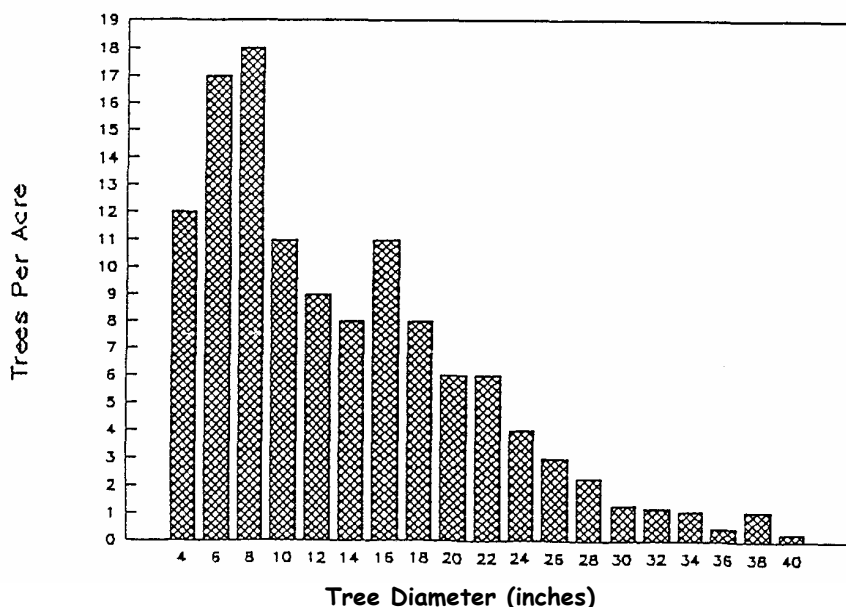
number of trees in smaller diameter classes is preferable in order to ensure that an adequate amount of regeneration is present and can keep the forest viable through periods of natural mortality.

As Figure 5 indicates, there are concentrations and deficits of specific diameter classes in the distribution. This is typical of a forest, such as SDSF, that has traditionally been managed on an even-aged basis. Most of the concentrations result from overcrowding, which suppresses growth (e.g., 16-inch diameter class). Those classes with deficits (e.g., 4-inch diameter class) contain low numbers because the overcrowded areas take up valuable space and nutrients that other size classes could use. Both the overcrowding and deficiency involved with these particular diameter classes can be remedied through a transition to uneven-aged conditions.

SILVICULTURAL TREATMENTS

Silvicultural treatments involve management decisions and actions which direct forest growth, harvest, and regeneration. Between the late 1920's and early 1940's, SDSF was managed on an even-aged basis with clearcutting and natural regeneration. Currently, forests in Santa Cruz County, including SDSF, are managed on an uneven-aged basis as required by the Coast Forest District's southern sub-district rules of the State's Forest Practice Rules. Two ways to establish and maintain uneven-aged conditions are through single tree or small group selection harvest; both of these methods will be demonstrated by SDSF. Although timber harvesting would focus on the removal of conifers, some hardwoods will also be removed to prevent hardwoods from dominating the residual stands.

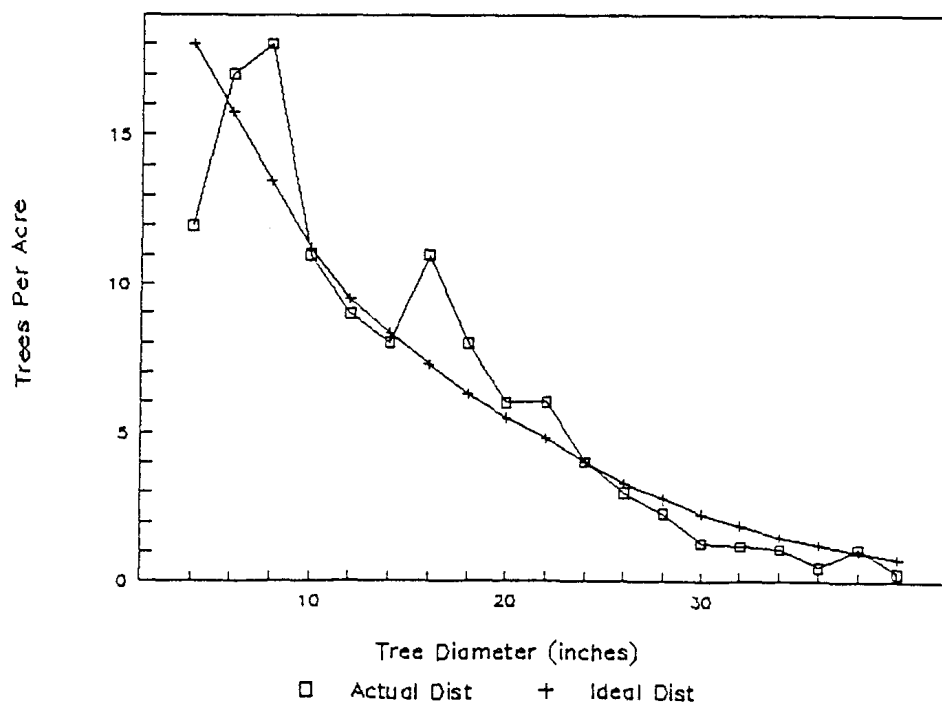
Figure 5. Diameter class distribution for SDSF.



To create an uneven-aged forest structure, a desired diameter class distribution will be determined and applied to create the favored structure. A transition period in which the desired forest size and age structure is obtained will conclude with the forest exhibiting a diameter distribution indicative of a truly uneven-aged forest (Figure 6). As illustrated, the idealized diameter class distribution forms the preferred inverse J-shaped curve of a traditional uneven-aged forest. Once established, the uneven-aged forest will be maintained through selective harvest in all of the merchantable diameter and age classes and through natural regeneration. Growing space must be provided for young, middle-aged, and mature trees. The preferred level of tree spacing will require a balance between achieving adequate regeneration and providing vigorous growth. Old-growth trees will not be included in uneven-aged management as they will be considered separately from the rest of the Forest (see the following Old-Growth and Late-Successional Management section).

As trees mature, growth rates level off and slowly decline until natural mortality occurs. Reduction of growth at any age, however, can be amplified by conditions such as overcrowding. Selective harvesting can improve stagnant forest conditions and enhance overall health. For example, removal of some trees from overcrowded stands will enable remaining trees to grow faster because of reduced competition for light, water, and nutrients. Sprouts and seedlings can also become established easier for the same reasons, thereby increasing both size and age diversity.

Figure 6. Current and idealized diameter distributions of SDSF.



In most cases, forest regeneration will be allowed to occur naturally. This is the best means for SDSF since the dominant tree species, coast redwood, sprouts quickly and vigorously from remaining stumps. In areas that do not regenerate sufficiently (e.g., areas of Douglas-fir or with heavy competition), supplemental tree planting will take place. Tree planting will also take place for research and demonstration purposes, experimenting with alternative means of forest regeneration. Redwood or Douglas-fir nursery stock will be favored over hardwood seedlings except in areas where hardwood regeneration is insufficient.

SILVICULTURAL PRESCRIPTIONS AND LANDSCAPES

Silvicultural activities such as harvest and regeneration require planning which is typically outlined in silvicultural prescriptions. Silvicultural prescriptions for SDSF will encourage attention to landscape perspectives and patterns that benefit vegetation, wildlife, and other values.

Management from a landscape perspective focuses on landscape patterns and the responses of biotic (e.g., plants, animals) and abiotic (e.g., soil and water) factors to changes in those patterns. A large part of this type of management involves the response of biota to disturbances (such as unnatural openings or burned areas) in the landscape, also known as edge effect. Edge effect, considered to be both beneficial and detrimental, can have impacts on species that are adapted to interior forested habitats. The use of selection methods for harvest, however, can help minimize negative impacts by eliminating sharp contrasts between areas of harvest and adjacent forested areas.

As part of demonstration and research objectives, SDSF will experiment with different sizes of group selection openings as well as feathering the edges of openings. The main purpose of experiments is to determine the extent of edge effect on biota associated with different harvest levels and sizes of group selection openings. Results of demonstration and research projects will be used in the development of future silvicultural prescriptions and activities.

CUTTING CYCLE

Designated forest stands will be selectively harvested once every ten years or more. The interval between these harvests is known as the cutting cycle. The length of cutting cycles will depend on tree densities, diameter distributions, growth rates, stand objectives and other parameters. Once these items have been analyzed, definitive cutting cycles can be specified. Preliminary results indicate that cutting cycles would vary from approximately 20 years in the short term (i.e., over the next decade) to 10-15 years in the long term (i.e., after five decades).

Traditionally, harvest at the end of a cutting cycle removes the amount of growth that has occurred since the previous harvest. This may be true for some stands, however, for most stands within SDSF not all of the growth between cutting cycles will be removed (see the Harvest Plan section). By not removing all of the growth, the amount of volume remaining following each stand entry will increase over time.

SILVICULTURAL TREATMENTS AND NON-TIMBER RESOURCES

One of SDSF's demonstration goals is to display that silvicultural treatments are compatible with aesthetic, biological, and recreation values. Ways to display this compatibility may include harvest methods which are aesthetically acceptable both from a distance and close-up, marking treatment boundaries so that they have minimal visual impact from roads or trails, and providing for habitat improvement through silvicultural prescriptions. These and other examples may be elements of demonstration programs directly related to timber harvest.

OLD-GROWTH AND LATE-SUCCESSION MANAGEMENT

OLD GROWTH

Existing old-growth redwood areas in the Forest have been excluded from all future timber harvesting, as mandated by SDSF's authorizing legislation AB 1965. Figure 7 shows that the areas are quite limited (approximately 25 acres) and broken into two to ten acre blocks. (A buffer zone surrounds each block and is included in the total acreage.) Individual old-growth conifer trees will be identified and marked for preservation during timber harvest preparations; individual tree characteristics, listed in Table 5, will be used to identify these old-growth trees in the Forest. (Table 5 compares tree characteristics for old growth against those of young growth.) No individual characteristic, including age, will be used to make a classification. Instead, combinations of these characteristics will be used to determine if trees are old growth or young growth.

LATE SUCCESSION

Late-succession management areas will be administered to promote the development of functional old-growth habitat characteristics through infrequent, low-intensity timber management activities. These characteristics include multi-level canopy structure which provides vertical and horizontal diversity, stand-age diversity, and large trees, snags, down logs, and other woody debris. Recruitment and retention of these characteristics, which provide important habitat elements for fish and wildlife species, will be attained through silvicultural prescriptions. For example, trees with crowns that extend over the stream will not be harvested unless a qualified hydrologist or wildlife biologist recommends removal of such trees to enhance riparian habitat or hydrologic

function. These trees may also be removed when recommended by a certified engineering geologist to help stabilize active slides. WHR classifications will be used to assess and maintain the specific wildlife habitat characteristics of these areas in SDSF.

Like areas of old growth, sections in the Forest designated for late-succession management have been identified and mapped (Figure 7). These areas make up 15 percent of the overall forest, and correspond to a width of 300 feet on each side of the East Branch of Soquel Creek, Amaya, and Fern Creeks within SDSF boundaries. Timber harvesting in these areas would conform to the following guidelines:

- * At least 75% total shade canopy in multiple layers would be retained.
- * At least 25% shade canopy in trees at least 24 inches DBH would be retained.
- * All woody riparian (i.e., hydrophytic) vegetation would be retained except where riparian function would be enhanced by removing such vegetation.
- * Large snags (i.e., standing dead trees at least 20 inches DBH and 15 feet tall) or live wildlife trees (i.e., trees that support bird nests or have cavities or large limbs that make them valuable for nesting birds) would be recruited (created from existing healthy trees) or retained at an average density of at least five per acre.
- * At selected locations where conifers are lacking, Douglas-firs and redwoods would be planted to promote long-term recruitment of large woody debris in streams.
- * Downed logs at least 24 inches in diameter and 30 feet long would be retained or recruited by felling trees at an average density of at least two per acre, and total coarse, woody debris would be retained at an average density of at least 10 tons per acre.

Site disturbance during harvesting operations in late-succession management areas will be kept to a minimum by restricting tractor use and cable-yarding corridors to predesignated trails. Furthermore, all trees to be harvested and all wildlife trees and downed logs to be retained will be marked. A registered geologist and a qualified hydrologist will also be utilized to review operations during timber harvest planning.

Areas along the creeks were chosen for a number of reasons, including protection of sensitive riparian zones, fisheries resources, and existing Watercourse and Lake Protection Zones (WLPZ). Furthermore, these areas provide habitat corridors and buffers between creeks and nearby harvested areas. Corridors are important for wildlife movement and survival, providing a valuable element to the landscape pattern.

Figure 7. Old-growth and late-succession management areas.

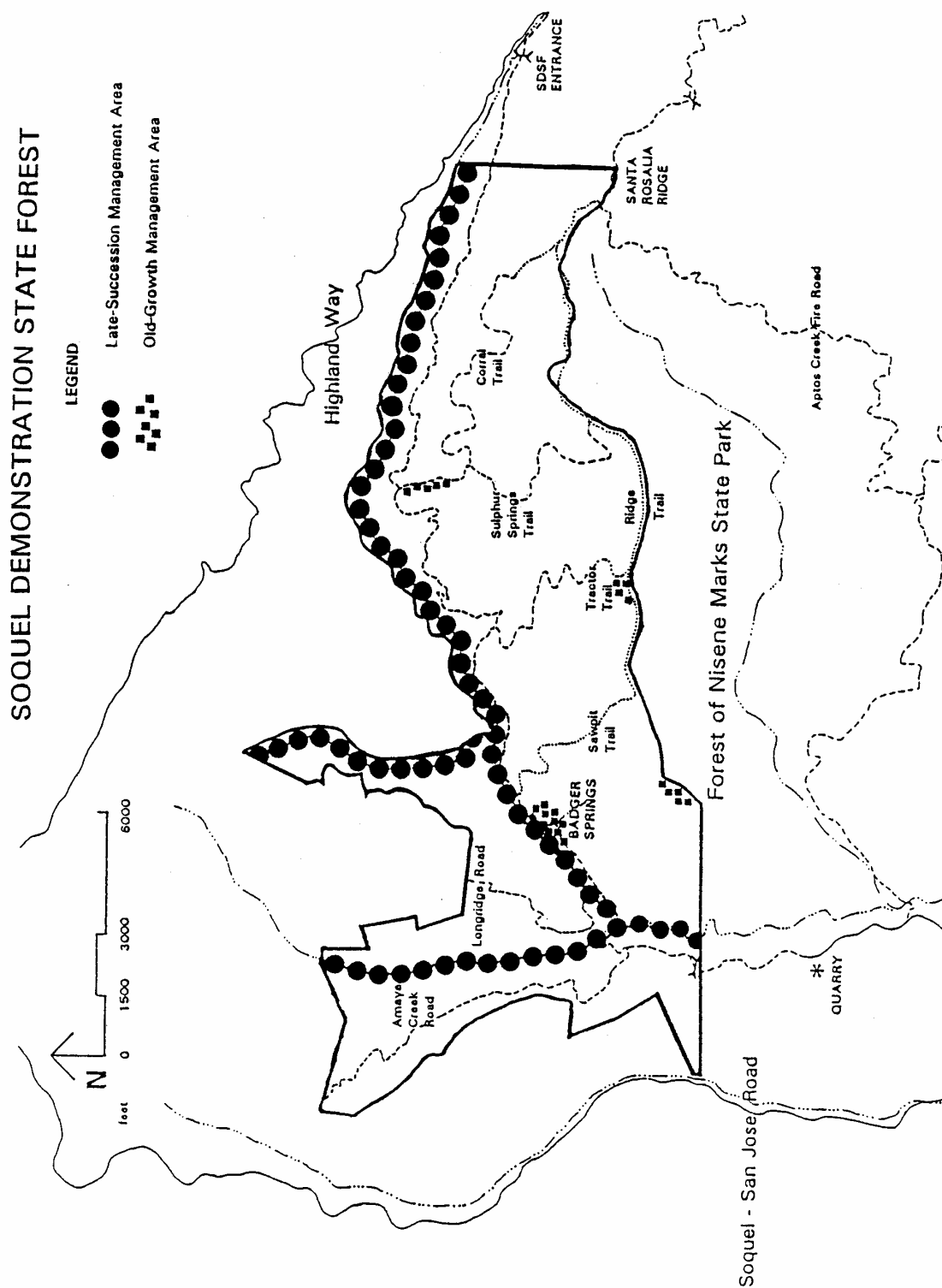


Table 5. Individual redwood and Douglas-fir tree characteristics.

<u>YOUNG GROWTH</u>	<u>OLD GROWTH</u>
Abundant branches or knots in the lower 1/3 of the bole (tree trunk).	Lower third of the bole is relatively free of branches or knot indicators.
Branches are small, 3 inches or less in diameter.	Large branches, many larger than 4 inches in diameter.
The tops of the crown are usually pointed and the branches are usually upturned.	Tops of crown are rounded or flat. Branches may be downturned.
Bark is typical of younger trees as described in dendrology books (shallow bark furrows).	Bark is typical of older mature trees as described in dendrology books (deep bark furrows, bark between furrows often plate-like).
Growth is generally fast, as indicated by large annual rings - usually less than 10 annual rings per inch.	Slow current growth as indicated by a long period of narrow annual rings - usually 15 or more annual rings per inch.
Excessive taper in open grown trees.	Very little taper, even in open grown trees.
Diameter at breast height (DBH) generally less than 48 inches.	Diameter at breast height (DBH) generally greater than 40 inches.
Tree age less than 175 years.	Tree age 175 years or greater.

Source: CDF

HARVEST SYSTEMS

The terrain where logging activities are to occur will be the key factor in determining whether ground skidding, cable logging, or aerial harvest systems are used. The erosion hazard, slope angle, slope stability, and distance to drainages will also be carefully evaluated in the selection of harvest systems. Additional factors include access, public safety, aesthetics, timing, noise, environmental mitigation, economic conditions, research, and demonstration aspects. The appropriate harvest system for each timber sale will be identified and utilized based on the above considerations. Refinements on the harvest systems used will be made as necessary to accomplish harvesting in an economical, efficient, and environmentally sound manner.

SYSTEMS FOR USE IN SDSF

Ground skidding logging systems, methods which tow logs on the ground to landings (loading areas), consist of tractor, rubber tire skidder, and horse logging. Horse logging, limited to gentle slopes and modest sized trees, can be used to minimize soil disturbance, damage to residual trees in dense stands, or for demonstrative purposes. Tractors and rubber tire skidders are generally used where slopes average less than 35 percent though steeper slopes will be considered on a site-specific basis. (This would only occur in SDSF after evaluations of slope stability and erosion hazard potential and the ability to mitigate any problems to negligible proportions.)

In SDSF, ground skidding equipment will be restricted to the minimum size capable of moving the harvested timber. Skid trail systems (temporary trails used by ground skidding equipment) will be designed so that existing skid trails are utilized where appropriate. All new and rehabilitated trails will be predesignated and placed at a minimum distance of 100 feet apart. A certified engineering geologist will participate in the preparation of all timber harvest plans to certify the locations of all proposed roads, skid trails, and landings on unstable soils, slide areas, and areas where the California Forest Practice Rules require that skid trails be designated before the start of timber operations.

Ground lead, high lead, and skyline logging, commonly referred to as cable logging, use cables to partially suspend logs off the ground while transporting them to designated landings. The cables are attached to a machine, called a yarder, which is equipped with multiple winches and a tower for pulling the cables. A wide range of cable systems are available for logging both large and small timber. In SDSF, cable yarding will generally be used on steep slopes, near drainages, or where road construction is difficult.

Aerial harvest systems incorporate the use helicopters and balloons to move logs from one area to another. These systems are beneficial when the erosion hazard or slope instability are high or when access to an area is limited. In SDSF, aerial

systems will be considered primarily for demonstrative purposes and where cable yarding is not possible. Helicopter timber drop-off and landing areas will be located at least 0.5 mile from the nearest occupied dwellings.

A preliminary logging plan for SDSF designated proposed tractor and cable yarding areas, existing and planned roads, and old growth areas (Figure 8). Based on this plan, approximately 1,700 acres are suitable for yarding by tractors and 900 acres are suitable for yarding by cable yarders or helicopters.

HARVEST SYSTEMS AND COMPATIBILITY

Harvesting operations will be planned and implemented to minimize conflicts with neighbors and visitors where possible. To accomplish this, road and skid trail construction will be designed with potential users in mind. For example, specific logging trails can be designed to serve as future recreation trails where appropriate. Certain logging trails may be closed, however, following harvesting activities where public access is inappropriate (e.g., research or sensitive areas, or where trespass across private property would occur). New roads and skid trails will be carefully located to minimize visual impacts. Additionally, the size and duration of area closures and traffic diversions will be evaluated for each timber sale.

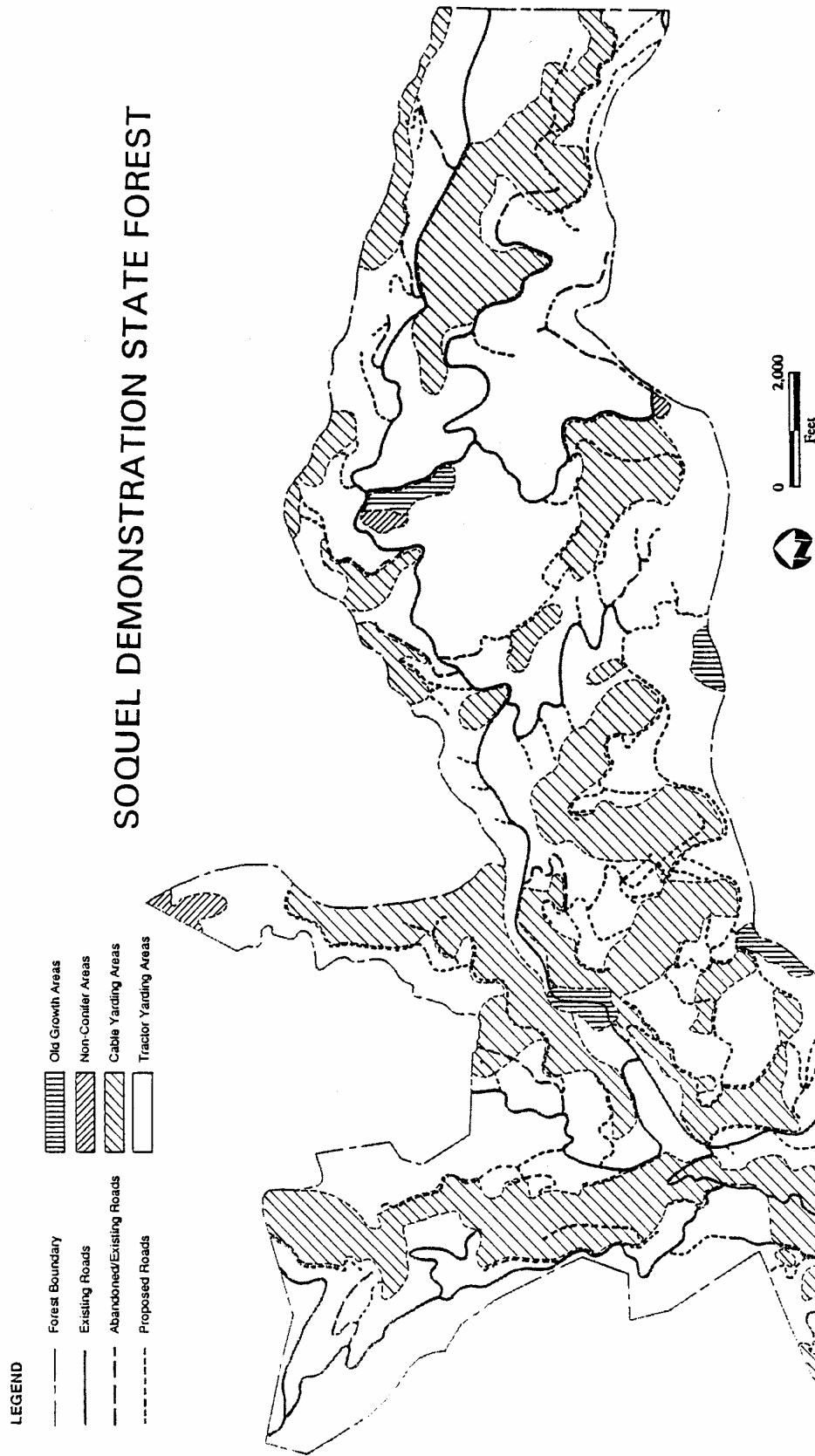
HARVEST PLAN

HARVEST LEVEL

Short Term

SDSF's annual harvest level for the next ten years will be between 500,000 and 900,000 board feet (approximately 20 to 35 percent of forest-wide growth). This harvest level is consistent with AB 1965 in that it provides for timber management demonstrations and promises an intensively managed research forest. In 1995, SDSF's first timber harvest removed 550,000 board feet. The second harvest, which is planned for 1998, is expected to harvest over 1.0 million board feet. Subsequent harvests are expected to yield 1.5 million board feet every other year, which is equivalent to 750,000 board feet per year or 30 percent of forest-wide conifer growth. This harvest rate is substantially lower than SDSF's current conifer growth rate of 2.6 million board feet per year and is approximately one percent of the standing conifer inventory. The maximum harvest level allowed regardless of the market price of timber or revenue needs shall be no more than 35 percent of growth or 900,000 board feet per year.

Figure 8. Preliminary logging plan.



Long Term

The harvest level is projected to gradually increase from 750,000 board feet per year in the first decade to approximately 1.55 million board feet per year in the fifth and subsequent decades. This gradual increase in harvest levels over the first five decades to the equivalent of 50-60 percent of forest-wide growth shall be the maximum percentage of growth harvested in the fifth and subsequent decades regardless of revenue needs. It is anticipated that the funds needed for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF will only be fulfilled once this harvest level is achieved. An analysis of sustained yield production was completed according to the California Forest Practice Rules (CCR 913.11) to determine the effects of this harvest level over time on average stocking level (i.e., timber volume per acre) and corresponding stand growth rates. This analysis concluded that the proposed harvesting schedule is sustainable over the long term (Jones and Stokes Associates, Inc., 1996).

Sustained yield production is achieved by balancing growth and harvest over time, maintaining a timber inventory capable of sustaining the long-term sustained yield (LTSY) (i.e., the harvest level projected to be sustainable after 100 years), and having the projected annual harvest level for all future rolling ten-year periods not exceed the LTSY. These results were demonstrated by projecting stocking conditions, growth, and harvest levels for the planning area over a 100-year period based on the best available information and accepted principles of forest management and statistics.

The land area within SDSF was grouped according to its availability for timber harvesting: unavailable (e.g., grasslands, brushlands, streams, ponds, trails, landings, inoperable areas, old-growth management areas, roads, and unconvertible hardwood areas; limited availability (e.g., late succession management areas, recreation sites, and unstable areas; and fully available. As a result, 55 percent of SDSF (1,475 acres) is fully available for timber production, 30 percent (805 acres) has limited availability, and 15 percent (400 acres) is unavailable.

Sustained yield production was analyzed based on the following highly conservative simplifying assumptions:

- * stand age averages 60 years;
- * all SDSF timberlands support mixed-species, mixed-age stands of redwood, Douglas-fir, and hardwood trees with an average stocking level of 30,000 board feet per acre;
- * all SDSF timberlands are currently growing at an average rate of 1,000 board feet per acre per year, and will maintain this average growth rate over a wide range of stocking levels and average stand ages;

- * harvesting will remove an average of 10,000 board feet per acre from fully-available lands and 3,500 board feet per acre from lands with limited availability each decade; and
- * the forestwide harvesting level will gradually increase from 750,000 board feet per year in the first decade to 1.5 million board feet per year in the fifth and subsequent decades.

The projected distribution of SDSF timberlands by average stocking level over the next ten decades is shown in Table 6. Based on the above assumptions, fully-available timberlands account for 86 percent of the total first-decade harvest, and lands with limited availability account for the remaining 14 percent. In the first decade, a total of 645 acres of fully-available land and 300 acres of less available land are harvested. The total area harvested each decade then increases through the fifth decade, when the entire 1,475 acres of fully-available land and 214 acres of less available land are harvested. From the fifth through the tenth decades, all fully-available lands are harvested (at the relatively light intensity of 10,000 board feet per acre) approximately once per decade (Jones and Stokes Associates, Inc., 1996).

As shown in Table 6 and Figures 9 and 10, the average stocking level on fully-available lands increases from 30,000 board feet per acre to a weighted average of 46,000 board feet per acre after ten decades. The average stocking level on lands with limited availability gradually increases over this period to 110,000 board feet per acre. Based on the stocking conditions projected for the tenth decade, the LTSY for SDSF is at least 1.7 million board feet per year; this estimate is very conservative. The LTSY could be increased if more harvesting occurred in the less-available land class. This analysis shows that the proposed harvesting schedule balances harvest and growth, maintains an inventory capable of producing the LTSY, and does not exceed the LTSY in any future period (Jones and Stokes Associates, Inc., 1996).

As part of the analysis for each succeeding decade, the short and long term harvest levels will be reevaluated based on the best available information at that time. The level of timber harvesting shall not exceed LTSY and on a cumulative basis shall be limited to the level of timber harvesting necessary to provide the funds needed for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF.

HARVEST PROCESS

Approximately every two years, SDSF staff will plan a timber sale, in accordance with environmental laws, which fulfills the harvest objective. Each plan will specify, at a minimum, the area and volume to be harvested, logging and silvicultural

methods to be used, and restoration and mitigation measures necessary to address environmental concerns. All potential harvests will be evaluated by CDF Forest Practice staff and will be available for public review.

Once a timber sale has been approved by the CDF Director, a minimum bid will be established for the sale. The timber designated for harvest will then be sold to the highest bidder. The timber purchaser will enter into a contract with the State which specifies all requirements in detail, including the operation and payment schedule, adherence to applicable laws, and any additional improvements or demonstrations. SDSF staff will administer the sale, assuring that the contractor abides by the contract. Furthermore, CDF Forest Practice Officers will periodically inspect the operation.

The harvest process will be administered through the CDF Class III permit system for major timber sales. Periodically, small timber sales (less than 100,000 board feet) may be offered for demonstration or research purposes. These harvests would require a Class I minor timber sale permit. Any conifers removed in minor sales or lost through catastrophe (wind, fire, flood, or pest infestation) must also be applied to the designated harvest level. In the event of a major catastrophe, salvage logging would occur and the annual harvest level would be recalculated.

TIMBER OPERATIONS MONITORING

To avoid adverse impacts on water quality and fisheries resulting from the discharge of sediment to watercourses attributable to timber operations, SDSF staff will monitor all timber operations (including all harvesting areas and new roads, skid trails, and landings) annually for 5-7 years following completion of the operations. Occurrences of substantial surface erosion (i.e., gullies) or mass wasting (i.e., landslides or slumps) resulting from the operations will be identified and described by a registered professional forester. Each substantial gully or landslide will be evaluated to determine its cause and identify stabilization measures that will be most feasible, effective, and cost effective. Such measures will be implemented within 90 days from the date when the subject site is identified, unless due cause for delay is explained and a reasonable alternative schedule for implementation is proposed by the forest manager. Appropriate mitigation measures to be incorporated into future timber operations will be described and specified in future timber harvesting plans to avoid a recurrence of the observed erosion or mass wasting events.

TIMBER MARKETS

The local timber market is largely influenced by the proximity of sawmills and economic conditions. The closest large sawmill to SDSF is the Big Creek Lumber Company mill, located 17 miles north

Table 6. Projected distribution of SDSF timberlands with full and limited availability by average conifer stocking level over ten decades.

Availability Class	Stocking Level (MBF/acre)	Acres by Decade									
		1	2	3	4	5	6	7	8	9	10
Full	30	1,475	645								
	40		830	1,455	955	620	620	620	620	620	620
	50			20	520	855	855	855	855	855	855
	Acres harvested	645	810	975	1,140	1,305	1,475	1,475	1,475	1,475	1,475
	Acres harvested as percent of acres in class	44	55	66	77	88	100	100	100	100	100
Limited	30	805									
	36.5		300								
	40		505								
	46.5			586							
	50			219							
	53				52						
	56.5				753						
	63					257					
	66.5					548					
	73						500				
	76.5						305				
	83							714			
	86.5							91			
	89.5								123		
	93								682		
	99.5									591	
	103									214	
	109.5										805
	Acres harvested	300	286	271	257	243	214	214	214	214	214
	Acres harvested as percent of acres in class	37	36	34	32	30	26	26	26	26	26

Source: Jones and Stokes Associates, Inc., 1996

Figure 9. Projected annual conifer growth and harvest on SDSF timberlands with full or limited availability.

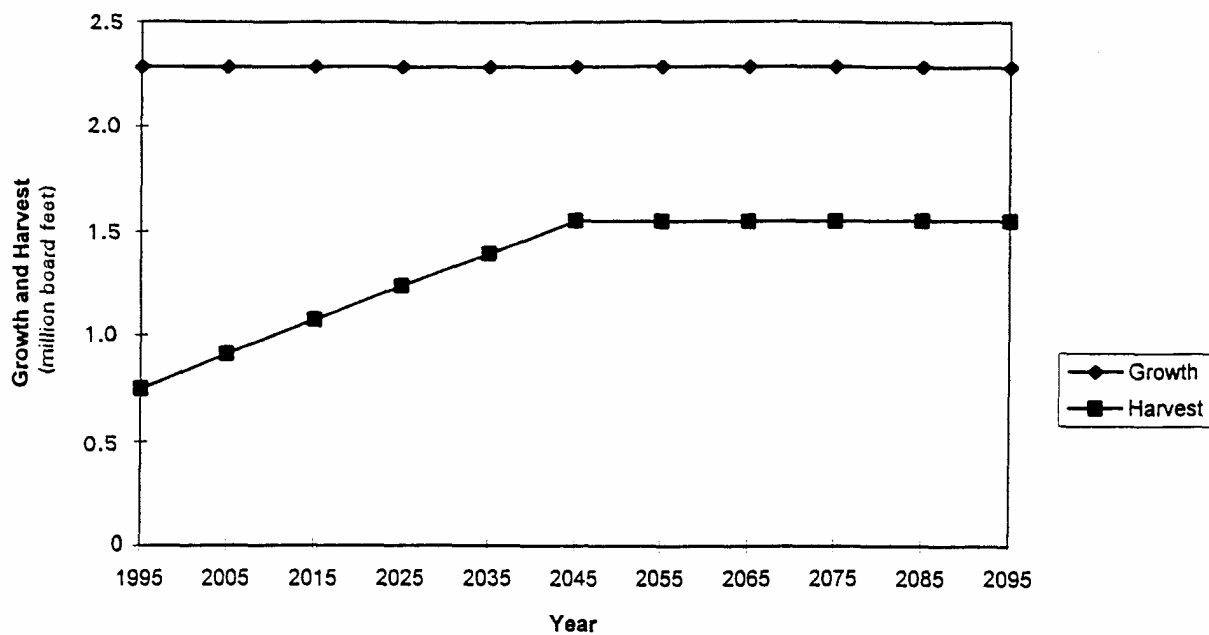
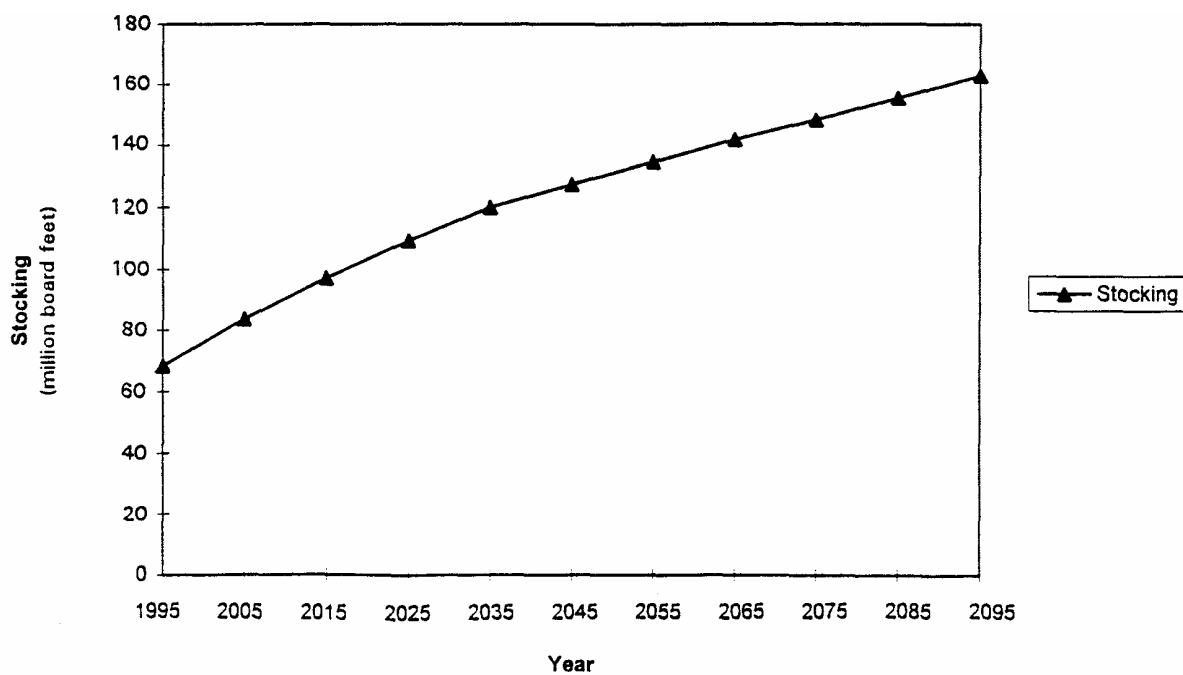


Figure 10. Projected aggregate conifer stocking on SDSF timberlands with full or limited availability.

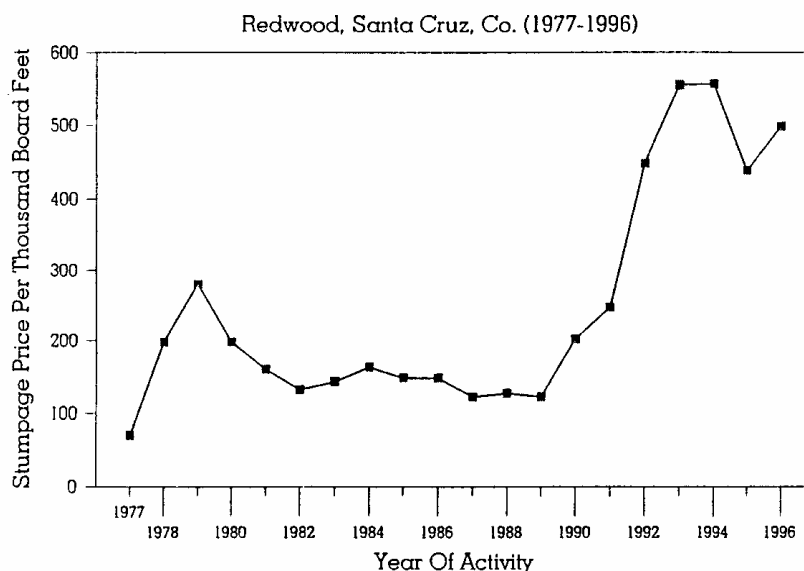


Source: Jones and Stokes Associates, Inc., 1996

of Santa Cruz. The next closest sawmills are operated by Redwood Empire and Preston Lumber in Cloverdale, 165 miles north of Santa Cruz on Highway 101. The Harwood Products mill in Branscomb, 250 miles north of Santa Cruz and west of Highway 101, handles mostly fir logs. The Sequoia Forest Industries mill, in Dinuba, is 150 miles southeast of the Forest.

The timber market has historically undergone fluctuations as a consequence of economic conditions. Figure 11 indicates dramatic changes in redwood stumpage prices during the last 20 years

Figure 11. Timber market stumpage prices.



(State Board of Equalization, 1996). Stumpage prices reflect the value of logs delivered to the mill less the costs of logging, hauling, and cleanup. In the 1990's, stumpage prices have been increasing. Factors contributing to this rise include a decline in federal timber sales, reduction of available timber elsewhere, increased forest regulations, and protection of threatened and endangered species. Furthermore, the demand for forest products remains strong, keeping prices high. These factors, along with the cyclical nature of the timber market, are expected to continue and influence market activity.

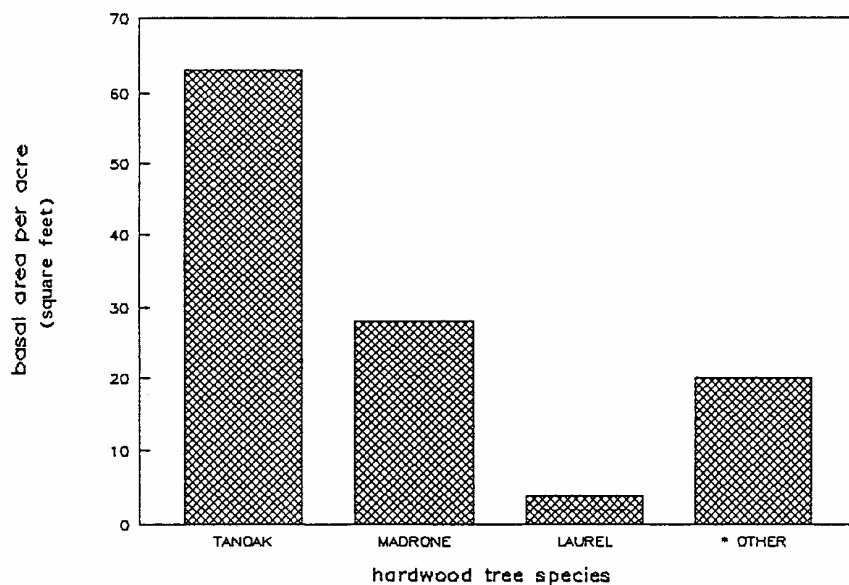
Timber values for SDSF are not expected to be equal to general redwood/Douglas-fir prices. Bidding competition for SDSF sales will generally be lower because of the scarcity of sawmills in the region. Harvesting operations will usually be more expensive because of the amount of rehabilitation and restoration work planned. For example, existing undersized road culverts will be

replaced, existing roads will be reshaped and surfaced to reduce erosion and additional fire hazard reduction work will be performed. These revenue reducing activities will be added to the cost of harvesting.

HARDWOOD MANAGEMENT

The 1991 inventory estimated hardwood basal area to be 116 square feet per acre. Figure 12 represents the hardwood basal area by the three most common species and a grouping of lesser occurring species (live oak, willow, alder, and bigleaf maple). As the graph indicates, tanoak is the most common hardwood species present. Hardwoods are a significant component of SDSF and, on average, comprise 40 percent of the basal area.

Figure 12. Estimated basal area for SDSF's hardwood tree species.



*OTHER = live oak, maple, willow, alder

Hardwood stands will be evaluated during wildlife and timber management planning. The forest type map discussed in the Conifer Volume Inventory section will classify hardwoods as well as conifers in SDSF. Areas that have always been hardwood will remain so and will be examined for wildlife habitat enhancement and research opportunities. Approximately 100 acres of SDSF timberlands that naturally support conifers but, as a result of past logging and other management, currently support pure or predominantly hardwood stands (primarily tanoaks and madrones) will gradually be harvested and reforested where appropriate by planting redwood and Douglas-fir seedlings. These stands are widely distributed throughout the Forest in units one-quarter to

one acre in size. A site specific analysis of potential biotic and wildlife habitat impacts will occur prior to all hardwood conversion. Any individual openings will not exceed 0.5 acres.

Another aspect of hardwood management will be to examine and experiment with alternative uses for hardwoods. The goal is to efficiently utilize more raw material, targeting portable sawmill owners, timber operators, and private property owners in the process. Some items that can be made from hardwood lumber include furniture, paneling, flooring, and decking. Hardwoods can also be utilized as fuelwood and chips. SDSF will research and demonstrate the management and use of hardwoods as a timber resource.

DEMONSTRATION AND RESEARCH PROGRAMS

SDSF's demonstration and research programs will integrate all facets of timber management consistent with PRC Sections 4660-4664 and subject to the limitations of this management plan. Each timber sale will serve as a demonstration but also may contain a research component. Research projects will evaluate the applicability, practicality, and effectiveness of various strategies of forest and watershed management. Timber management demonstrations will include planning and operational projects as well as tours showing the risks and benefits of timber harvesting. Additional information on projects can be found in the Demonstration and Education and Research chapters.

Findings of research and demonstration projects will be available to the general public, small private landowners, researchers, and the forest products industry. Information will be distributed through research publications, direct mailing, and libraries.

SDSF can best serve the general public by providing information and experiences which enhance understanding of forest management principles and good land stewardship. The best way to provide learning opportunities is through exposure to forest management activities. Demonstration subjects might include the complexities of land management, trade-offs involved with timber harvesting, and the extent of wood products utilized by consumers. With this information, the public can make their own informed decisions regarding the effects of forest management.

Small private landowners can gather useful information and learn to plan more efficiently by viewing land management alternatives. Visiting project sites and observing results is an effective way to understand management techniques and how they might apply to private land. Of most benefit will be practical, directed projects that clearly demonstrate timber management, natural resource enhancement techniques, and solutions to specific problems.

Timber operators and industrial land managers will have the opportunity to view various harvesting and environmental

protection techniques. Demonstration and research project ideas will be solicited from this group. Possible projects may include evaluating methods to enhance forest health and regeneration, testing new harvest and management techniques, and solving operational problems.

MINOR FOREST PRODUCTS

The primary minor forest product that will be sold from the Forest is fuelwood. Fuelwood, primarily from hardwood tree species, will be available on an intermittent basis, usually as the result of other management activities. These activities may include road work, fuel break construction or maintenance, by-products of timber sales, and wildlife habitat improvement projects.

Additional forest products may be sold as they become available. These include salvage sawlogs, redwood split salvage, cull logs, roots and stumps, posts, boughs and other greens. As with the hardwood management program, the use of these products promotes utilization of raw materials that might otherwise accumulate and present safety or fire hazards.

PUBLIC COMMENTS AND CONCERNS

Comments and concerns regarding SDSF's timber management program have been very detailed and encompass a variety of subjects. Since it is impossible to address every comment directly, five broad topics of concern which cover most comments have been identified.

The first and probably most important concern to neighbors and other users of SDSF involves disturbance caused by logging activities. Logging truck traffic on mountain roads, reduced access to the Forest, alteration of the forest viewshed, and noise are sources of apprehension for many individuals. As stated in the management guidelines below, SDSF will strive to reduce possible impacts to forest neighbors and users during all forest management activities.

Another concern that has generated many comments deals with the possibility of negative impacts on Forest wildlife. Comments generally focus on the effects of timber harvesting on wildlife habitat, including concern for streams and adjacent riparian areas. SDSF plans to evaluate and monitor the response of various plant and animal species to forest management activities. Results of studies may include strategies to improve adverse conditions, enhance mediocre areas, or maintain exceptional situations.

The third area of attention deals with revenue from State Forest harvests. Interested individuals have expressed an opinion that SDSF should only harvest enough to cover basic expenses and that

revenue should only be used for these expenses only. CDF recognizes that PRC Sections 4660-4664 limits the level of harvests on a cumulative basis to that necessary to provide the funds needed for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF. CDF must also comply with California Forest Practice Rules and Board of Forestry policy. The Department will not attempt to accurately estimate revenues over any specific time period. As revenues increase over time, the Department will request expenditure augmentations through the normal budget process. Final state forest allocations ultimately rest with the Legislature.

Concern for the natural instability of the Soquel Creek watershed and excessive soil loss is also prevalent. Logging activities in the forest will adhere to California Forest Practice Rules which limit road and skid trail construction. These regulations require site-specific mitigation as necessary to reduce erosion to minimum levels. Additionally, environmentally sound logging practices and experimental research will be used to minimize damage to this sensitive area.

Finally, neighbors of SDSF would like to see local loggers, trucking companies, and mills perform the felling, hauling, and milling of products from the Forest's timber sales. While this may be ideal, the bid process cannot be limited to local businesses. In some cases, the highest bidder will likely be local, keeping the work and revenue in the Santa Cruz area.

MANAGEMENT GUIDELINES

1. Maintain and enhance a healthy forest ecosystem. This includes the monitoring of basic resources and requiring management activities that ensure forest vigor. The Forest will be periodically surveyed on an informal basis for general health, with emphasis on disease and insect activity, tree growth and vigor, and soil stability. Other monitoring activities, such as those developed for fisheries and wildlife, will contribute additional information on the health of individual resources within the ecosystem.
2. Protect and monitor the watershed, soil, fisheries, and wildlife resources during all timber harvesting activity. The fundamental goal is to minimize impacts to these resources through planning and mitigation developed on a site specific basis. Protection measures may include selecting low impact harvest methods, avoiding sensitive areas, and conserving or improving resource integrity. Timber harvesting will not occur during the period of winter operations (October 15 through April 15).

3. Design timber management activities based on landscape perspectives. Components to consider will include horizontal and vertical forest structure, vegetation density, edge effect, corridor size, and biological diversity.
4. Timber sales will have demonstrational value and include experimental and educational aspects whenever possible. This may include pre-harvest and post-harvest activities as well as actual harvest procedures.
5. Consider neighbor and visitor concerns during all timber harvesting activities. SDSF will strive to reduce excessive noise, visual impacts, and transport activity. Logging methods and haul routes that facilitate reduced disturbance will be evaluated on site-specific bases and used as appropriate.
6. Demonstrate timber management compatibility and integration with recreation. Whenever possible, design timber sales to minimize conflicts with recreational use and improve recreation facilities such as roads and trails. Additionally, safe recreational behavior during logging activities will be encouraged through signs, direction from SDSF staff, and alternative routes.
7. Each timber harvesting operation will include sediment source remediation. High-priority remediation sites will be considered when selecting areas for upcoming harvests. In some cases, remediation at locations other than timber harvest areas could constitute offsite mitigation for the watershed impacts of harvesting.

PLANNED ACTIONS

1. Harvest between 500,000 and 900,000 board feet per year for the next ten years. This is approximately 20-35 percent of forest wide growth.
2. Protect all old-growth redwood and Douglas-fir trees in the Forest. Promote the development of functional old-growth habitat characteristics in late-succession management areas within 300 feet of the East Branch of Soquel Creek, Amaya Creek, and Fern Gulch.
3. Identify planned harvest areas for the ten-year period 1998 to 2007. Evaluate all possible harvesting and silvicultural methods, new road construction needs, and compatibility with other forest uses for each area under consideration.
4. Develop a forest type map which includes tree species, WHR classifications, forest structure, and vegetation density. As resources permit, create a Geographic Information System (GIS) database for the Forest which contains this forest

type map. The database will eventually include information on soil characteristics, streams, topography, research, inventories and roads, trails, facilities, and other improvements.

5. Reinventor the Forest by the year 2000. The new inventory will collect information by forest type including timber volume, tree age, growth, mortality, stand structure, and WHR characteristics. The remeasurement interval and sampling scheme will be specified in the inventory design.
6. Monitor all timber operations annually for 5-7 years following completion of the operations. Any substantial surface erosion or mass wasting found will be identified and described by a registered professional forester and evaluated to determine its cause. Identify and implement stabilization measures that will be most feasible and cost effective within 90 days. (Refer to Appendix C, Monitoring Plan.)
7. Convert approximately 16 acres of hardwoods back to conifers over the next ten years. Individual openings will not exceed 0.5 acres.

RESEARCH

INTRODUCTION

It is Board of Forestry policy for all state forests to conduct innovative research in forest management. The purpose of such research is to provide resource management information to the general public, small forest landowners, and the forest products industry. Research opportunities in SDSF are numerous, offering small or large, general or specific, and experimental subjects. Individuals conducting research may represent private organizations, including consulting firms and environmental protection groups, or public agencies, such as institutions of learning or resource-based departments.

A plan to identify specific subjects of concern and research priorities for SDSF needs to be formulated so that continuous and long-range studies can commence. Forest staff will investigate possibilities and rely heavily on what the public, CDF officials, and resource professionals would like to see analyzed.

COMPLETED PROJECTS

Six research projects, summarized below, have already been completed for resources within SDSF. Procedures and results of each study are outlined in their respective chapters with the exception of the Geologic Survey, which is covered in the Property Description chapter.

ARCHAEOLOGICAL STUDY

A complete surface field survey for archaeological and historical sites was conducted in 1991 by Dr. Brian Dillon. Dr. Dillon is a consulting archaeologist affiliated with the California State University at Northridge. Sites found during this study will be protected for cultural, research, and educational purposes.

BIOLOGICAL ASSESSMENT

An inventory and assessment of SDSF's biota was completed by biologists from California Polytechnic State University, San Luis Obispo, in 1993. The survey resulted in lists of all plants and animals seen, heard, or tracked in the Forest (refer to Appendix B for species lists). The study, which concentrated on special status species, was under the direction of Professors V.L. Holland and Mike Hanson.

GEOLOGIC SURVEY

An extensive geologic survey of SDSF involved detailed mapping of geologic features. This analysis was conducted in 1992 by Michael Manson and Julie Sowma-Bawcom of the California Division of Mines and Geology. Mapped information includes geologic characteristics, landslides, stream orders, and areas where mitigation work can be done.

RECREATION STUDY

A recreation survey to determine forest recreational users' views and use patterns was sent to the neighbors of the Forest and the local mountain community. Copies of the survey were also distributed in the State Forest and in The Forest of Nisene Marks State Park. Results of the study have been a primary source of public input into the forest management planning process. The principal investigators for the study were Marcia McNally and Randy Hester from the University of California, Berkeley.

TIMBER AND GROWTH INVENTORY

A forest-wide timber inventory and supplemental growth analysis were conducted to determine the current conditions of forest volume and vigor. The timber inventory, completed in 1991 by SDSF staff, surveyed both conifers and hardwoods on a ten percent sample of the Forest. The growth study used a portion of the plots established by the timber inventory but assessed the current growth rates of conifers only.

WATERSHED ASSESSMENT

A comprehensive cumulative watershed effects analysis for the East Branch of Soquel Creek watershed was completed by CDF forest hydrologist Pete Cafferata. Chris Poole, a student intern from the University of California, Santa Cruz, and Forest staff assisted with data collection. Information obtained from the assessment should allow future management activities to maintain or enhance watershed and soil integrity.

RESEARCH PRIORITIES

Subjects for research will include all ecosystems in the Forest but are likely to focus on elements in riparian and coast redwood forest habitats. Studies will concentrate on all components of resource management, including protection, management, and public use. Initial research priorities are listed below; as forest management techniques evolve, precedence will adjust accordingly.

WATERSHED MANAGEMENT

- * Monitor the effects of forest management activities on the resources of the East Branch of Soquel Creek watershed within SDSF.
- * Investigate stream enhancement and rehabilitation techniques.
- * Control erosion and stream sedimentation caused by logging, road building, and recreational use.

TIMBER MANAGEMENT

- * Investigate optimal spacing requirements for growth and regeneration.
- * Study hardwood management.
- * Study old-growth redwood forest communities and ways to achieve late-succession stand characteristics over time.
- * Investigate logging techniques which minimize visual, auditory, and environmental impacts.

FISHERIES AND WILDLIFE

- * Assess the current condition of the fisheries resources within SDSF.
- * Study methods to improve steelhead and coho rearing habitat conditions.
- * Investigate methods to improve wildlife habitat and provide for healthy biodiversity.

RECREATIONAL USE

- * Monitor environmental impacts of visitors to the Forest.
- * Study the reactions and responses of recreational users and neighbors to all forest management activities.

PUBLIC COMMENTS AND CONCERNS

The general public's wishes regarding research include desire to be kept informed of SDSF's research plans and actions, both presently and in the future. Specifically, curiosity relating to research subjects, objectives, and investigators (and their affiliation) has been prevalent. To satisfy this concern, SDSF plans to announce current research projects through publications such as the Mountain Network News and other local newspapers. Additionally, newsletters containing information on present activities will be posted on signboards throughout the Forest.

Other public comments have suggested that information derived from research studies should be used to formulate forest management policy and actions. Gaining information which will aid in the management of SDSF is essentially the purpose of

research projects; the Forest staff intends to put to use relevant information obtained through research.

A final category of public interest involves the availability of study results. Individuals have expressed that research findings be made available as conclusions may be applicable to their own lands. As stated in the management guidelines below, results will be available through public libraries, natural resource journals, CDF publications, and direct mailing.

MANAGEMENT GUIDELINES

1. Actively design and carry out continuing scientific studies which refine and improve upon existing state of the art forest land management techniques.
2. Coordinate research projects with other state forests and local, state, and federal public agencies. Additionally, research opportunities may be provided for universities, industry professionals, and private interest groups. Research may be formal or informal, depending on the party conducting the study and available funding.
3. Assure dissemination of research results in a timely and professional manner. Information gained from studies will be made available to local, state, and federal public agencies as well as resource professionals, forest neighbors, and other interested individuals. Reports may be made available through direct mailing, newsletter articles, public libraries, or professional natural resource journals.

PLANNED ACTIONS

1. Develop a comprehensive research plan that evaluates research subjects and priorities, identifies proper audiences, and defines techniques to distribute information effectively and in a timely manner. The plan will encourage innovative research in forest management, resource protection, and recreation. An investigation to develop the plan will examine previous research to determine the extent of what has already been completed in the area as well as topics lacking in information.
2. Serve as an outdoor laboratory for CDF research projects and encourage investigations by other agencies and educational institutions. Use study results to improve forest practices both in the Forest and statewide.

RECREATION

INTRODUCTION

The legislation creating state forests (Public Resources Code 4631-4664) and Board of Forestry policy both state that recreation is to be an integral part of the Demonstration State Forest Program. In addition, SDSF's enabling legislation, AB 1965, states that public enjoyment and open access are to be provided. SDSF's recreational management goal is to provide for uses that are compatible and integrated with resource protection, public education, and forest management while following the guidelines of AB 1965 and Board of Forestry policy.

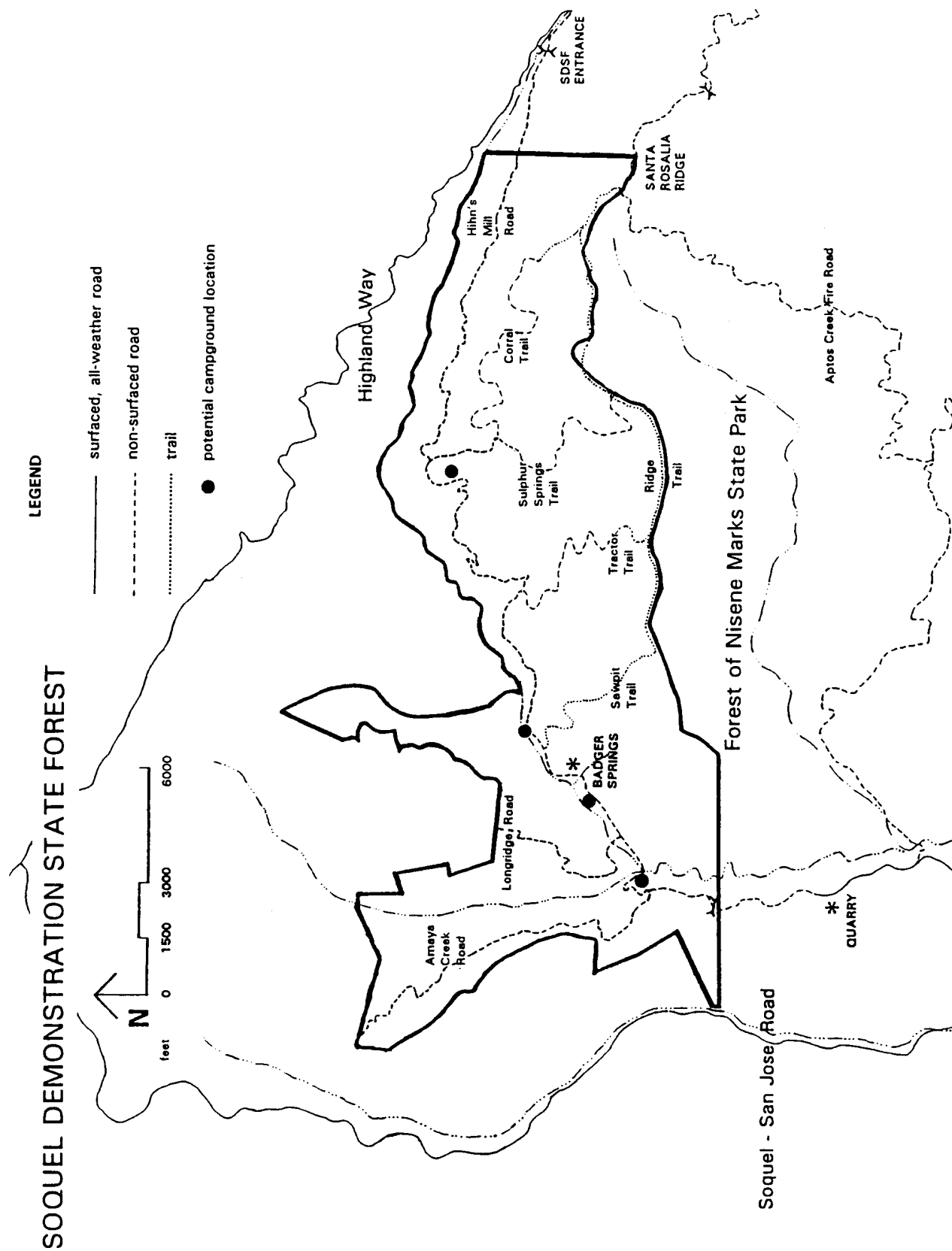
Prior to state acquisition of SDSF in 1988, the property was privately owned and used primarily by the owners, their guests, neighbors bordering the property, and frequent trespassers. Users consisted of equestrians, motorcycle riders, four-wheel drive enthusiasts, hunters, target shooters, and a limited number of hikers, mountain bikers, and campers.

Since the establishment of SDSF, recreational use of the Forest has changed. Current groups who utilize the forest are (in order of use) mountain bikers, hikers and walkers, and equestrians. The increase in mountain bikers has resulted from an overflow of riders from The Forest of Nisene Marks State Park (TFNMSP) and community awareness of a new riding place. Other recreational users include picnickers, occasional mushroom gathering groups, bird watchers, environmental organizations, a dog search and rescue training organization, and people coming to enjoy the forest environment. Nonmotorized public access is allowed during daylight hours. Camping, campfires, hunting and the use of firearms are not permitted at the present time.

The recreation plan, which will be completed following the approval of this general plan, may call for development of one rustic group campground for occasional use by groups using SDSF for education, nature study, and recreation. Although the exact location of the proposed campground has not been determined, it may be located at one of four sites (Figure 13).

Current forest regulations prohibit all recreational motor vehicle use. The primary grounds for this regulation are poor road alignment and maintenance costs. Other reasons include resource protection, safety, and fire prevention. The enforcement of regulations has decreased the number of motorcyclists to a few violators, and four-wheel drive enthusiast use is now almost non-existent.

Figure 13. Recreational trails of SDSF and potential campground locations.



THE RECREATION STUDY

To gain a better idea of current and future recreational users, their views, and related issues, SDSF implemented a recreation study which obtained information from the community and current users. The study, intended to be the primary source of citizen involvement in the recreational planning process, was designed to develop recreational and forest management strategies for SDSF. The results were to provide baseline information about existing and potential recreational users that will be utilized as more detailed recreation planning occurs.

The recreation study involved mailing questionnaires to all individuals who share a boundary with the Forest or live nearby. Additionally, different user groups who frequent the Forest were asked to fill out surveys while visiting SDSF. Information about the Recreation Study and the questionnaire were also published in the Mountain Network News, the Summit community's local newspaper. Of the 6,600 individual questionnaires distributed, 800 were returned.

RESULTS

Included here is a partial summary of the findings and recommendations from the study, and what the staff has done to address these issues. For complete details see the Soquel Demonstration State Forest Recreation Study Final Report (McNally and Hester, 1993).

Access

- * **Findings:** Recreational access is currently a significant problem. Many users trespass through private property to enter and leave the Forest. At this time, only one remote, legal access point that provides parking exists. This entry, the main entrance to SDSF, consists of an easement across private property and is subject to winter closures. Furthermore, those who do not use trails (e.g., physically challenged individuals) are limited to using the edge of the Forest only.
- * **Recommendations:** Providing alternative access requires a complete analysis of access needs and an assessment of land available for easement or acquisition. Accommodating non-trail users should be a consideration in future recreation and education planning.
- * **Actions To Date:** Forest patrols have been increased and citations to trespassers have been issued. Publishers of trail guides have been contacted to correct errors and promote an accurate depiction of public access routes. Additionally, loop trails have been developed to reduce trespass. Alternative access routes are being evaluated; a comprehensive analysis within the context of a detailed recreation plan is needed.

Signs and Maps

- * **Findings:** A number of survey respondents felt that the Forest needs more directional signs and a better map for orientation purposes.
- * **Recommendations:** A map that correctly depicts Forest trails, roads, and access points is a high priority. More clearly visible signs should be placed throughout the Forest, including the entrance at Highland Way.
- * **Actions To Date:** All high-use loop trails as well as the entrance and main road have been signed and the SDSF brochure and map have been redesigned to correct previous shortcomings.

Shooting and Hunting

- * **Findings:** Illegal shooting at Rattlesnake Gulch, private property across Highland Way from the Forest, is a detriment to Forest visitors. Gunfire can be heard throughout the Forest and many users find this unnerving. Additionally, the noise and danger of gunfire reduces the quality of users' forest experiences.
- * **Recommendations:** No recommendations were made to resolve the shooting problem at Rattlesnake because the area is not within state control.
- * **Actions To Date:** The Forest staff has worked extensively with the landowner, County Board of Supervisors, Planning and Public Works Departments, and sheriff's office to solve this problem. The area has now been gated and fenced, reducing the problem significantly. Observed target shooters at Rattlesnake Gulch were asked to leave and informed of local shooting ranges.

Neighbors' Concerns

- * **Findings:** Some neighbors are concerned that recreation and timber harvesting will disrupt their quality of life in the mountain community. They are worried that too many people will come from the larger metropolitan areas and impact their roads, increase fire danger, and vandalize property. Some individuals have expressed concern regarding excessive noise and their views being destroyed by timber harvesting.
- * **Recommendations:** Every effort should be made to consider the impact of proposed management activities on surrounding neighbors. Work with the community to aid in their understanding of SDSF as public land with certain legislated mandates that include education, public use, and logging. A demonstration that includes visual impact analysis for preparation of timber harvests could be considered.

- * **Actions To Date:** Several public meetings and tours have been conducted to discuss SDSF mandates and hear public concerns. Access issues are being investigated and detailed recreation and timber management planning are proposed. Motor vehicle use within the Forest is restricted, limiting the types and levels of recreational use.

The Forest of Nisene Marks State Park

- * **Findings:** Sharing a common boundary with TFMNSP is positive and offers prime recreational opportunities for both facilities. Recreationists, particularly mountain bikers and hikers, are starting to use both facilities in one outing. Some people think the Forest is part of TFMNSP. Management staff of both facilities have a good working relationship with one another.
- * **Recommendations:** The relationship between TFMNSP and the Forest has much potential. Thinking of the common boundary as one when problem solving could lead to beneficial solutions for both facilities, extending the State's resources that much further.
- * **Actions To Date:** Managers of both facilities meet regularly to share information and solve common problems, strengthening their relationship. As a result of this alliance, the new map has been updated to reflect the connections of the Ridge Trail in SDSF with the Aptos Creek Fire Trail of TFMNSP.

Forestry Education

- * **Findings:** There is an encouraging level of interest in the Forest's educational potential. Local teachers are interested in bringing classes out to the Forest and local residents like the idea of educating the general public about the environment.
- * **Recommendations:** Recreational users should be included in the Forestry Education program. Rest stops for different user groups will need to be located so that interpretive materials can be distributed to all recreationists.
- * **Actions To Date:** Outreach programs have been initiated with local schools and natural history organizations. Forest staff members offer verbal educational information to the public, both in the office and out in the Forest.

Multi-Use Trails

- * **Findings:** Currently, SDSF does not suffer the problems and conflicts experienced on other public lands that allow hiking, horseback riding, and mountain biking on the same trails.

- * **Recommendations:** Successful multi-use trail systems are rare. The State Forest should work to become a model in effective multi-use trail management. The satisfaction of all user groups should be closely monitored.
- * **Actions To Date:** Forest trails are open to all user groups and trail etiquette is stressed to Forest visitors. A Trail Use And Safety Guide has been developed to foster cooperative use and reduce trespass problems.

EXISTING FACILITIES

TRAIL SYSTEM

The trail system of SDSF consists mostly of old logging roads that have been reopened (Figure 13). Currently, many of the trails are not completely contained within the State Forest. Some trails lead from the State Forest to the State Park and others end at private land. Some trails do connect with other trails, however, and can be used as loop trails. Loop trails are necessary to the trail system as they keep visitors inside the Forest and direct them back through the State Park or to Highland Way, instead of onto private property.

Trails are shared by all recreational users, except for one half-mile of Ridge Trail between Corral Trail and TFMNSP. Horses are not allowed on this upper section to keep them from entering the Park, as they are not permitted due to deed restrictions.

Trail Descriptions

Ridge Trail - 3.3 miles

Ridge trail leads from TFMNSP at the southeast corner of the State Forest and follows Santa Rosalia Ridge to Sawpit Trail. It meanders along the common boundary between the State Forest and TFMNSP. This trail is the only other legal public access route to the Forest aside from the main entrance at Highland Way.

Sulphur Springs Trail - 1.5 miles

This trail starts on Hihn's Mill Road and goes up to Ridge Trail. It was constructed in the 1870's to access the Sulphur Springs Resort. The trail passes remnant cold springs, but all of the old resort buildings have been destroyed or removed. This route also serves as an emergency vehicular access to the helipad on Santa Rosalia Ridge.

Corral Trail - 1.7 miles

Corral trail starts at Sulphur Springs Trail and connects with Ridge Trail toward the southeast end of the Forest. It is named for an old corral, less than half way up the trail, that was used by the Sulphur Springs Resort to house their livestock.

Tractor Trail - 1.5 miles

This trail was constructed in 1934 when logging methods changed from steam donkey to crawler tractor. It was the first logging road developed to access the slopes of Santa Rosalia Ridge. It starts at Hihn's Mill Road and ends at Ridge Trail.

Sawpit Trail - 1.2 miles

This trail is the most recently developed trail in the Forest. It starts at Hihn's Mill Road and connects with Ridge Trail. It is located one-half mile east of the picnic area at Badger Springs. There is a sawpit along the trail that was used before the turn of the century for cutting logs into lumber.

Long Ridge Trail - 1.5 miles

This trail starts on Hihn's Mill Road and travels to Long Ridge Road. The last 0.1 mile is on private property. This trail is primarily used by neighboring equestrians.

OTHER FACILITIESPicnic Areas

The Badger Springs picnic site was the first such area in the Forest and was established long before the State assumed management. This area is very scenic and, consequently, is a common destination for Forest visitors. Badger Springs is located along Hihn's Mill Road in the alluvial flats of the East Branch of Soquel Creek. The site has several picnic tables, a few log benches, and 13 hitching posts for horses. On the opposite side of the road is the Forest's two-acre old-growth redwood grove.

Other picnic area locations are the Forest entrance, Sulphur Springs, and on Ridge Trail between Sulphur Springs Trail and Tractor Trail.

Outhouses

There were two portable outhouses in the Forest that have been removed due to budget cuts. They may be brought back if funding becomes available. Alternatively, permanent structures may be constructed if designated by future recreation planning.

Sign Boards

There are three information boards in the Forest that provide brochures, maps, and public information for visitors. The boards are located just inside the Highland Gate entrance, at the Badger Springs picnic area, and on Ridge Trail at the southeast edge of the Forest. The Ridge Trail sign board also provides TFNMSP information as it lies on the boundary between the Park and the Forest.

Parking Area

There is one parking area located just outside the Highland Gate entrance. This area is not in SDSF, but the State has a public-use easement with the owners, Roger and Michelle Burch. The parking area is closed in the winter as it does not have an all-weather surface and is susceptible to damage by motorcycle and four-wheel drive vehicle use. Currently, winter visitors park at turnouts along Highland Way.

PUBLIC COMMENTS AND CONCERNS

Many comments and opinions were gathered during the Recreation Study. Appendix A of the study's final report contains all of the results of the questionnaire as well as comments and concerns of users and neighbors. The major public concerns, such as access, are addressed in the Results portion of this chapter's Recreation Study section as well as in the study itself. For detailed comments, refer to Soquel Demonstration State Forest Recreation Study Final Report.

MANAGEMENT GUIDELINES

1. Public safety will be emphasized in all patrol and management planning activities. Violators of Forest regulations will be cited. Prohibited activities include use of motor vehicles within SDSF, camping or fires without a permit, entering closed areas, and fishing (per Department of Fish and Game Regulations). The Forest is also administratively closed to shooting and hunting.
2. In accordance with Board of Forestry policy, recreational facilities will be maintained with minimal development, preserving the rustic and informal characteristics of the Forest. Periodic assessments will be made to ensure that facilities meet users' needs while remaining as natural as possible.
3. Regular maintenance will be provided to ensure the upkeep and safe conditions of all existing facilities, including picnic tables, signboards, parking areas, and trails. Periodic inspection of recreational facilities will be performed by Forest staff and supplemented by communication with visitors regarding the condition of these facilities.
4. Recreation will be coordinated to achieve integration and compatibility with timber management, resource protection, demonstration and education, and the neighboring community. Demonstrations will show how recreation and timber harvesting, two seemingly conflicting management objectives, can be integrated. Interpretive resources will explain the basics of forest management and the need to protect sensitive resources. In addition, visitors will be directed away from private property through circulation patterns (loop trails), use of proper signing (directional,

regulation, no trespassing), and keeping forest attractions away from private property boundaries.

5. SDSF will be managed to provide positive experiences for all recreational users. Forestry education will be an integral part of the recreation experience. Proper trail etiquette between mountain bikers, equestrians, and hikers will be encouraged through signs, educational information, and patrol by staff and volunteers.
6. Management will strive to reduce recreational development and recreational use impacts in SDSF's riparian areas. The majority of riparian areas in the Forest are not suited for recreational use and will not be developed. Remaining areas, however, will not be foreclosed to recreational use or forestry education options. Any recreational improvements in riparian areas will be based on site-specific evaluations.

PLANNED ACTIONS

1. Additional recreation planning beyond the scope of this General Forest Management Plan is needed. A detailed and comprehensive Recreation Plan shall be developed based on the results of the Recreation Study. The new plan will offer solutions to existing conflicts, including access and user circulation patterns. Additionally, alternatives for recreational use such as hunting and a rustic group campground will be considered and safety concerns and hazard mitigation examined.
2. Recreational development levels that allow the maintenance of SDSF's rustic qualities will be determined through the proposed Recreation Plan. Public input into development levels shall be encouraged.
3. Establish special volunteer programs to enhance recreational opportunities. Programs which incorporate docents to help with interpretation and forest education (see the Demonstration and Education chapter) and patrol the forest via foot, horse, or mountain bike. Facility development and maintenance will be coordinated with demonstration and education programs.
4. Conduct ongoing patrols of riparian areas including those with existing facilities to enforce prohibitions on vandalism and other damage to riparian habitat related to public use. Implement additional restrictions on public use as needed. (Refer to Appendix C, Monitoring Plan.)
5. Record and compile descriptions of all reported nuisances caused by public users at SDSF or on adjacent ownerships including, but not limited to, trespass, vandalism, littering, and noise. Implement additional restrictions on

public use as needed. (Refer to Appendix C, Monitoring Plan.)

6. Compile annual estimates of public use of SDSF in user days using camping records, surveys, and other information. (Refer to Appendix C, Monitoring Plan.)

RESOURCE PROTECTION

FIRE PROTECTION

The San Mateo-Santa Cruz Ranger Unit Chief is responsible for fire protection in the State Forest. The Forest Manager, the Operations Officer-South, and the local CDF Battalion Chief will work together to ensure an adequate fire protection program is in place for SDSF. In addition, the Forest staff will work with other agencies as needed to provide fire protection for the Forest.

FIRE HISTORY

A 50-year fire history (1929-1979) of the Santa Cruz Mountains was compiled by Jason Greenlee in 1981. The area which is now SDSF was included in the study, and the following fires occurred during that 50-year period:

- 1933 - 240 acres burned in the Amaya Drainage.
- 1936 - 54 acres burned along Santa Rosalia Ridge between Tractor Trail and Sawpit Trail.
- 1936 - 118 acres burned in the Hinkley Basin, with approximately 25 acres in the Forest, along the ridgeline at the top of Sulphur Springs Trail.
- 1938 - 87 acres burned along the upper portion of Sulphur Springs Trail.
- 1957 - 168 acres burned from Highland Way to Hihn's Mill Road, just east of Ashbury Gulch. Approximately 50 acres were in the Forest.

The exact causes of these fires are not known, but it is believed that logging practices of the past, coupled with high risk machinery and equipment, caused most of them. Phil Mason, a long-time local resident, remembers that the 1933 fire was caused by a steam donkey engine that caught fire, burning the Amaya Drainage.

Modern logging methods and equipment are much safer from a fire perspective, and the risk of fire has been greatly reduced. This is evident from the lack of fires in the Forest during the last 30 years. The only known recent fire occurred in 1970 when the High Bridge, at the southwest edge of the Forest, was set on fire by an arsonist.

The most recent large fire in the area was the Lexington Fire in July of 1985. Though not in the State Forest, the fire's impact to the Summit mountain community was severe enough to mention

here. An arsonist started the fire which burned 13,800 acres in the Los Gatos Creek Drainage (600 acres were in Santa Cruz County). Forty-five hundred people were evacuated from their homes, including residents of the Summit area. In the end, 44 structures were destroyed, including houses and outbuildings.

PRE-SUPPRESSION

Pre-suppression is defined as fire protection activities performed before fire occurrence to ensure effective fire suppression. Pre-suppression plans discuss site-specific ways to minimize loss and reduce hazard and risk. The current pre-suppression plan for SDSF will be updated by the local CDF Battalion Chief with assistance from the Forest Manager. The more comprehensive plan will include the definition and assessment of high risk and hazard areas within the watershed boundaries, maps of fire defense improvements, prevention techniques, and an evaluation of available resources. State Forest staff is currently working on some of these activities.

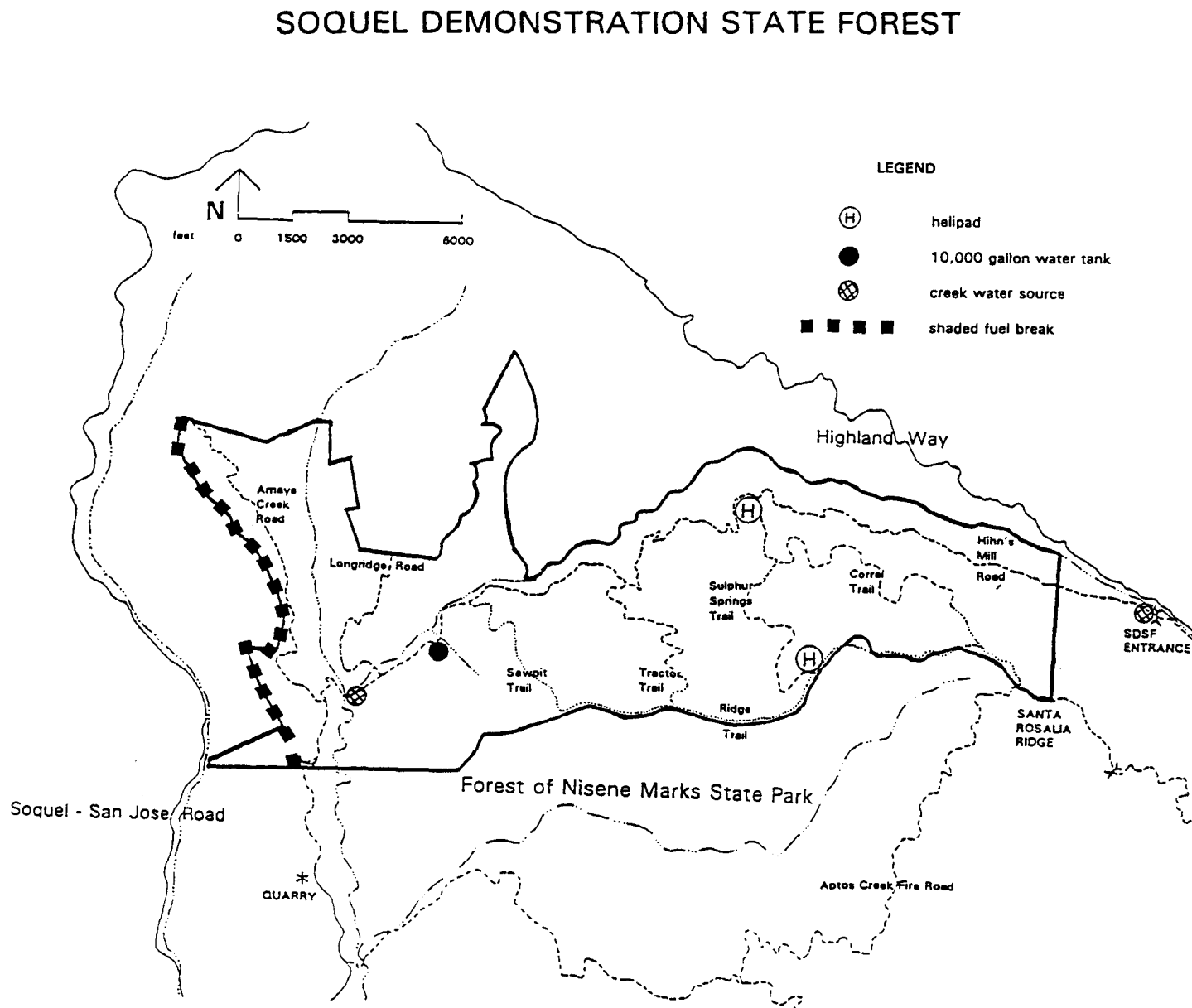
Fire Defense Improvements

Fire defense improvements will be strategically located to protect forest land and neighboring properties. Improvements in the State Forest will include one or more water tanks (e.g., 10,000 gallons), water sources along the East Branch of Soquel Creek, shaded fuel breaks, and helipad locations (Figure 14). The water sources and tank will be positioned so that water will be available throughout SDSF during a fire emergency. In addition, appropriate signing, fire hazard reduction, and adequate access to roads and trails will be added or maintained. Fire hazard and prevention information as well as Forest regulations will be posted on all information boards. The parking area, information boards, and picnic areas will be treated to reduce fire hazards for safety and demonstration purposes. The major roads and trails in the Forest are in the process of being opened to provide access for fire protection purposes.

Shaded fuelbreaks protect high value areas such as forest land, historical sites, and neighboring property. Typically, they are areas 100 to 300 feet wide where vegetation and other forest fuels have been decreased in order to reduce the rate of spread of an advancing fire. All dead trees and ladder fuels (shrubs and lower tree limbs) are removed and the overstory canopy is thinned to a level where shade will still retard the growth of new ground fuels. The understory is modified so that a low-growing ground cover is retained within the fuelbreak to provide fuels to start a backfire. Whenever possible, fuelbreaks should visually merge with the surrounding landscape, conforming to the natural features of the area. Periodic maintenance will be needed to maintain fuelbreak specifications.

Shaded fuelbreaks in SDSF will be constructed, with the help of crews from Ben Lomond Youth Conservation Camp, along ridges and high use roads and trails. This is to provide safe locations for

Figure 14. Proposed fire defense improvements.



fire control lines and backfiring; ridgelines are commonly used as control points. In addition, bladed fuelbreaks or the modification of fuels around homes will be considered on a site specific basis, as subsequent planning occurs.

Regulations

Restrictions are in effect for hunting and shooting, smoking, and fires in the Forest. Smoking and fires are not permitted anywhere in the Forest, including parking areas. A possible exception to these regulations would be campfires in a proposed permit-only group campground (to be addressed in the Recreation Plan for SDSF). Hunting and shooting are administratively prohibited in the Forest.

The periods of extreme fire danger for SDSF usually occur from July through October though these periods may be extended by severe weather. During these periods, SDSF will follow the Ranger Unit's Red Flag Alert Plan. This is consistent with the plan The Forest of Nisene Marks State Park follows during extreme fire danger conditions. The Forest Manager will coordinate with the Operations Officer-South to determine necessary actions to be employed. The steps include increasing patrols of the Forest, posting red flag alert signs, providing more fire prevention information and awareness of current conditions to Forest visitors, and reducing the number of visitors in the Forest by posting the area as closed.

Education

SDSF staff will coordinate with the Fire Prevention staff for educational purposes. Educational information will be used to reduce the number of human-caused fires within the State Forest. Target groups will include neighbors, visitors, school groups, and local organizations. In general, neighboring property owners pose a risk of human-caused wildland fires in the Forest. They will be encouraged to meet with Burrell and Soquel Forest Fire Station personnel for information on CDF's Fire Safe Program in order to minimize the risk of wildfire.

Signs will be posted on all information boards alerting Forest visitors to the dangers of fire and ways they can minimize these dangers. Dangerous Fire Area signs will be posted when appropriate. During regular patrols, visitors will be informed of fire hazards and prevention methods.

School groups and local organizations will be referred to the Fire Prevention staff or local forest fire stations for fire safety information and presentations. Groups visiting the Forest for education programs will be informed of fire safety, hazards, and prevention techniques.

Enforcement

Forest patrol is an important part of fire protection and prevention. SDSF staff will coordinate with the Fire Prevention staff for patrol purposes. Patrols will include public contact, fire detection, and patrol of roads and trails during the fire

season. CDF personnel will be utilized for weekend patrols and major holidays, especially during periods of high fire danger. CDF peace officers will either provide direct supervision or lead these activities. Additional patrols may be conducted by volunteers as deemed appropriate and safe by CDF.

Fire suppression cost recovery will be pursued for damages resulting from deliberate and negligent acts of Forest users. Active investigations will be used to locate responsible parties and recover maximum legal damages.

SUPPRESSION

Suppression tactics are based on information from and implementation of the pre-suppression plan. SDSF staff can support initial attack fire control personnel by providing local expertise regarding current road conditions, vegetation, and cultural resources. The staff may also evacuate visitors, close the fire area, perform law enforcement tasks, and assist with media information as appropriate.

Detection

Detection strategies include daily patrols, searching for evidence of fires, and CDF air flights during extreme fire danger periods or after lightning storms. Also, the Ranger Unit's Emergency Command Center will check the Automatic Lightning Detection System (ALDS) for possible strikes in the Forest.

Communication

As part of communication, SDSF will maintain an adequate radio system and stay in close contact with local forest fire stations (Burrell, Soquel, and Corralitos). Local CDF fire control personnel will become familiar with the Forest, its road and trail systems, water sources, and landmarks (for use as reference points) and be advised of any changes that occur.

CDF's resource tracking system, Computer Aided Dispatch (CAD), will be used to dispatch the appropriate personnel and equipment to any fires on SDSF. The State Forest is a defined response area within CAD. The staff will inform the Emergency Command Center of any changes or updates to the CAD database, including information on roads, access points, and fire defense improvements.

POST-SUPPRESSION

Post-suppression activities include the evaluation of pre-suppression information, suppression actions, and rehabilitation needs. Rehabilitation involves erosion control and other restoration activities. Ranger Unit personnel will evaluate post-suppression activities on an individual fire basis.

To minimize increases in wildfire risks resulting from increased public use in the Forest, the staff will record and compile descriptions of all wildfires occurring at SDSF. This

information will be evaluated annually. If an increase in wildfire frequency occurs, appropriate measures will be implemented as needed to reduce wildfire risk.

PRESCRIBED FIRE

Prescribed fire is the controlled use of fire under specific weather and fuel moisture conditions within a predetermined area. Fire, under these conditions, produces the intensity of heat and rate of spread required to accomplish specific management objectives. These objectives could include fire hazard reduction, silvicultural research, and ecosystem enhancement.

A prescribed fire program that involves these objectives will be evaluated for SDSF. A risk and benefit assessment will be the first step in the evaluation. The greatest risk is the loss of fire control and resulting damage that may occur. Benefits include a reduction in fuel load, removal of exotic plant species, and improvements to vegetation and wildlife habitats. A prescribed fire program must consider the mountain community's concerns and address them effectively. An established prescribed fire program provides research opportunities for both resource management and fire behavior purposes.

If a prescribed fire program is established in SDSF, a weather station will be established and monitored, fuel loads and types will be sampled and mapped, and burning prescriptions will be developed for the different vegetation types found in the Forest.

PUBLIC COMMENTS AND CONCERNS

On April 29, 1993, SDSF held a workshop designed to gather information, comments, and concerns from the public. Based on the comments received, there are four major issues concerning fire protection and SDSF.

The first issue involves uneasiness about logging equipment and its potential to cause fires. As stated earlier in this chapter, modern logging methods and equipment are much safer and less likely to generate fires than historic logging practices. Additionally, logging contractors are required by law to develop a fire protection plan for each THP and to follow the state's Forest Practice Rules regarding fire protection. During harvest activities in SDSF, periodic inspections will be performed by both Forest Practice Officers and Forest staff.

The risk of fire as a result of recreational use is also a concern. Individuals commented on issues such as limiting the number of people allowed in the Forest during periods of high fire danger and the prohibition of fires and camping at all times. Forest policy is to inform users of fire danger and to discourage activities that may result in fire risk. Similarly, camping, hunting and shooting, and motor vehicles are prohibited in SDSF though they may be allowed in the future (to be addressed in SDSF's proposed Recreation Plan).

The third issue raised at the workshop concerns the use of prescribed fire in SDSF. Comments about the consequences of both using and refraining from prescribed burning were received. As mentioned above, a risk and benefit analysis will be completed and analyzed before any decisions are made in this area. Lastly, comments regarding fire defense improvements vary from concern about how improvements may change the character of SDSF to suggestions for road accessibility. Currently, roads in the Forest are kept clear of combustible vegetation by Ben Lomond Youth Conservation Camp crews and Forest staff. Likewise, the condition of roadbeds are examined periodically and maintained as needed. Though fire defense improvements may change the appearance of some areas, their presence is needed in order to allow timely and effective response should a fire occur.

PLANNED ACTIONS

1. Coordinate with the Battalion Chief and other fire control personnel to develop a comprehensive pre-suppression plan for SDSF.
2. Determine fire defense improvement locations and initiate their construction. Include the Operations Officer-South in all decisions.
3. Provide patrols to enforce fire prevention policies, coordinating with the Fire Prevention staff as needed. Forest staff and volunteers will patrol SDSF on weekends and holidays, especially during periods of high fire danger. The Forest will be closed to public use when fire risks become excessive.
4. Conduct fire prevention education for neighbors and Forest visitors utilizing SDSF and fire prevention staff members.
5. Work with the Department of Parks and Recreation personnel from The Forest of Nisene Marks State Park to ensure effective fire protection along Santa Rosalia Ridge.
6. Record and compile descriptions of all wildfires occurring at SDSF including ambient weather and fire hazard conditions, ignition source, area and vegetation types burned, and estimated damage. Implement appropriate measures as needed to reduce wildfire risks. (Refer to Appendix C, Monitoring Plan.)
7. Evaluate the needs and feasibility of a prescribed burn program.

FOREST PEST MANAGEMENT

Forest pests, such as insects, diseases, and vertebrates, have long been established in California's native timberlands. Populations of pests are dynamic and fluctuate in response to

climatic and environmental changes such as drought, forest overstocking and windthrow, fire, and other site disturbances. The actual or potential effects of pests may reduce or threaten to reduce anticipated tree growth, species composition, or forest stocking. At the same time, other forest resources, such as wildlife habitat, may be impacted. Integrated forest pest management is a way to address all of these issues and make any possible multiple resource impacts related to pest management as insignificant as possible.

The intent of integrated pest management (IPM) is to prevent or restrain forest pest problems by both pest population suppression and the minimization of factors which predispose trees to infestation. IPM may make use of the benefits of cultural, mechanical, chemical, semiochemical (i.e., synthetic pheromone), and biological pest management alternatives, reducing pest populations and promoting forest health. For pest problems in SDSF, management options that successfully merge with short and long term forest uses will be selected.

Pests known to have caused whole or partial tree mortality within and adjacent to SDSF are listed in Table 7. Other pests of tree species that occur within the Forest may be present but have never been reported or detected. Still, other pests known to these tree species in other locations could be translocated to SDSF.

Table 7. Forest pests of the Soquel Creek watershed.

PEST	HOST
Fungal Diseases	
black stain root disease	Douglas-fir
<i>Armillaria</i> root disease	Douglas-fir, oaks (<i>Quercus</i>)
madrone canker	madrone
Insects	
flatheaded fir borer	Douglas-fir
Douglas-fir beetle	Douglas-fir
redwood bark beetle	redwood
oak bark beetle	oaks (<i>Quercus</i>), tanoak
California oakmoth	oaks (<i>Quercus</i>)
Mammals	
squirrel	redwood

Tree mortality rarely occurs as a result of a single type of pest infestation. Typically, a single pest invades and weakens a tree, making it vulnerable to attack by some other agent. Beetles, for example, favor trees that have been weakened by other agents such as fungal infections, windthrow, or fire. Conversely, beetles can transmit spores from fungi-infected trees to healthy ones, ultimately leading to tree mortality.

Monitoring is an essential part of detecting early signs of forest pests or scenarios that may lead to infestation. Part of pest monitoring in SDSF will involve forest health surveys to detect pest damage or infestations in standing trees, slash, windthrow, down woody debris, or stumps. SDSF will also assist the pest monitoring program of the California Department of Food and Agriculture by deploying and inspecting gypsy moth traps in high use areas of the Forest. Other efforts to reduce pest damage or predisposition will include:

- * The minimization of injuries to residual trees during forest management activities.
- * Reuse of old skid trails to avoid further soil compaction.
- * Retention of a diverse species composition in stands following forest management activities and in any future plantings.
- * Avoidance of non-native tree species which may be predisposed to pests and fewer pest predators and parasites.
- * Use of CDF or other forest pest management specialists to train employees in forest pest recognition and management.

PLANNED ACTIONS

1. Continually monitor the Forest for signs of pests and notify the CDF Forest Pest Management Specialist of any findings. Take action as needed to minimize or eliminate any problems.
2. Thin dense stands of trees where necessary to maintain healthy growing conditions.
3. Provide applied forest pest research opportunities to interested agencies, institutions, or organizations.
4. Coordinate with Santa Cruz County in the detection of and protection against gypsy moths or other introduced pests.

WATERSHED ASSESSMENT

PHYSIOGRAPHY OF THE WATERSHED

SDSF is located almost entirely within the drainage of the East Branch of Soquel Creek, its landbase covering approximately 21 percent of the basin. For the most part, the Forest is underlain by fine grained sedimentary rocks that are highly weathered and easily eroded. The headwater channel of the East Branch follows the San Andreas Fault Rift Zone and is heavily disturbed from landslides triggered by earthquake activity. Hillslopes throughout the Forest are commonly steep and prone to large, deep-seated landslides. Even greater instability occurs in active inner gorge zones near stream channels. When compared to mass erosion events (e.g., large landslides), surface erosion of the loamy soils is of minor significance.

As stated in the Property Description chapter, the Soquel Creek watershed has a Mediterranean climate with cool, wet winters and warm, dry summers. Mean annual precipitation in the East Branch watershed varies from 30 to 46 inches and takes place primarily between November and April. Discharge records from the USGS stream gauging station located immediately upstream from the bridge in the town of Soquel show that the average discharge is 1.1 cubic feet per second per square mile. High intensity, long duration winter storms, however, produce extreme levels of runoff. This occurred during the January 1982 runoff event, producing log jams and flooding in the town of Soquel. Singer and Swanson (1983) state that the village has a chance of being flooded once every seven to ten years.

BENEFICIAL USES

The two main beneficial uses of the East Branch are cold water fisheries and water supplies for various purposes. The East Branch supports spawning and summer rearing habitat for steelhead trout, but the number of returning fish has declined significantly in the past 25 years (refer to the Fisheries chapter). For example, in 1982 populations were only one-third to one-quarter of what they were thought to have been 30 years ago (Singer and Swanson, 1983). The major factors limiting anadromous fish populations are believed to be low summer flows and limited rearing habitat due to siltation of pools and removal of woody debris.

The other primary beneficial use in the main stem of Soquel Creek is water supply. Numerous small diversions exist that provide water for domestic, agricultural, and industrial purposes. Two permitted domestic water supply systems exist in the main Soquel Creek watershed that utilize surface flow, but apparently there are no permitted systems utilizing surface water in the East Branch basin.

Diversions and overdrafting of groundwater in low discharge summer months have dewatered portions of the stream channel during drought years. This is likely to be a critical limiting factor for the fisheries resource in the lower part of the basin. The largest diversion in the East Branch is operated by the Olive Springs Quarry. After complaints by the city of Capitola in 1988, the State Water Resources Control Board concluded that a watermaster was needed to effectively regulate water use under low flow conditions, particularly during drought years, due to the complicated interrelationships of the water rights on Soquel Creek. To date, however, no watermaster has been appointed.

LAND USE HISTORY

The major types of land use in the East Branch watershed are timber management, recreation on public land, ranching, and residential development. The East Branch watershed's long history of timber harvesting began with clearcutting in the 1870's and continued into the 1940's. Timber was originally removed by oxen (1870-1895), then by steam donkey (1895-1930), and finally by crawler tractor. Following World War II, selective harvesting replaced clearcutting, continuing to the present day. Currently, nearly all of the old-growth timber has been harvested except for minor reserved groves and widely scattered suppressed trees. Second-growth harvesting has taken place on approximately 790 acres over the past 10 years (Jones and Stokes Assoc., Inc., 1995). In recent years, cable yarding has been used along with tractor logging to selectively harvest timber in the basin.

Recreation in the form of hiking and mountain biking takes place primarily in The Forest of Nisene Marks State Park and SDSF (SDSF also allows horseback riding). Additionally, adjacent property owners often allow friends and neighbors to utilize their lands as an access route to the park or SDSF. The Olive Springs Quarry, located near the East Branch channel, has produced sand and gravel from granitic rock exposed along the Zayante Fault for over 30 years. Residential development has occurred in the chaparral communities and has steadily expanded over the past 25 years. Approximately 20 percent of the basin is dominated by chaparral and has never been harvested.

CUMULATIVE WATERSHED EFFECTS ASSESSMENT

Cumulative watershed effects (CWE) can be defined as the combined impacts on the beneficial uses of water. These impacts occur within and away from the locations of actual land use and are transmitted through the fluvial system. When considering CWE, it is appropriate to estimate how current and future projects, when combined with impacts from past activities, will influence beneficial uses present in the basin under review. Techniques to determine whether CWE are adversely impacting beneficial uses

have been developed, but resource professionals acknowledge that no fully adequate method yet exists. The methods utilized here are based on the best current knowledge available to address the problem.

SDSF's CWE assessment was conducted in 1992 and 1993 by CDF Hydrologist Pete Cafferata, UC Santa Cruz student Chris Poole, and Forest staff. Since specific harvest units had not been defined, the entire Forest served as the project area. The assessment area was the East Branch itself, which encompasses areas outside of the Forest. (Assessment areas must be large enough to detect past impacts and small enough to determine what the impacts of the proposed projects will be on the area.) The CWE assessment completed for the East Branch watershed evaluated the current condition of stream channels in the basin and determined how they would likely be altered with future timber operations.

The CWE analysis for SDFS was broken down into two main tasks: a stream channel inventory and a hillslope erosion/sedimentation evaluation. The stream channel inventory was completed in 1992 and illustrates the current condition of the channel network within the assessment area. Channel stability was rated with the US Forest Service's Pfankuch Method, while channel condition was evaluated with CDF's Guidelines for Assessment of Cumulative Impacts (Poole, 1992). Due to limited personnel and time constraints, stream channels within SDFS were analyzed in greater detail than channels located in other areas of the basin.

The hillslope component of the CWE evaluation was completed in the summer of 1993. Quantitative estimates of erosion risk and erosion volumes associated with anticipated activities (e.g., timber harvesting and road building) were made based on the results of the Critical Sites Erosion Study (CSES; Lewis and Rice, 1989). A selected number of random sample locations were installed on existing, planned, and abandoned roads, as well as past harvest areas. The resulting data was input into equations to estimate the risk of generating critical, or large, erosion sites (i.e., a large erosion event producing more than 100 cubic yards per acre). These equations are based on measurements made for slope, amount of hillslope or road curvature, soil color, and rock hardness.

On-site measurements were made to assess other sources of erosion not addressed by the CSES. Estimates were then made of the amount of sediment that could result from the approximated erosion. The significance of the estimated sedimentation was studied by comparing it with expectations of sediment yield for Soquel Creek. Since data from the Soquel Creek basin was not available, information from the San Lorenzo River, a similar, neighboring basin, was used. The methodology utilized for the hillslope erosion and sedimentation analysis was designed by Rice (1993) and has been used in several parts of the state. Results of the CWE study are reported in Cafferata and Poole's Watershed Assessment for the East Branch of Soquel Creek (1993).

FINDINGS

Locations in the assessment area found to have poor stability and channel conditions were Amaya Creek, Hinckley Creek, and the East Branch between Ashbury Gulch and the upper SDSF boundary. The reaches with the best ratings for stability (high-fair) and channel conditions were the upper part of the East Branch above SDSF and the main stem of Soquel Creek below the junction with the West Branch. Intermediate in stability and channel conditions were the reaches of the East Branch between Ashbury Gulch and the junction with the West Branch.

Summarizing the results for the 10 miles of the East Branch surveyed, fair channel stability was the general finding (10% good, 67% fair, and 23% poor). (This compares reasonably well to the fair/poor relative overall rating for sediment and log contribution assigned to the East Branch by Singer and Swanson [1983]). The exception was the highly impacted reach along the San Andreas Rift Zone. Additionally, the major tributaries were severely degraded by heavy landsliding activity. Very large quantities of sediment are stored in these headwater tributaries, as well as in wide, vegetated terraces along the lower reaches of the East Branch.

Observation of the East Branch channel revealed that riffle stretches generally had cobble and gravel sized particles protecting the stream bottom surface. Inspection of stable pools below Ashbury Gulch, however, showed that this habitat type contained significant percentages of fine sediment. Large woody debris was not found to be blocking anadromous fish passage in the East Branch, but was limiting habitat use in the major tributaries. Wood has accumulated in a few fairly stable locations but is lacking in the remainder of the channel. Large woody debris is valuable because of the pool habitat for young steelhead that forms around it in gravel dominated stream systems.

Results of the hillslope evaluation indicate that the risk of generating critical erosion sites is not significantly different from the average for the rain-dominated portions of the northern Coast Ranges in California (Cafferata and Poole, 1993). Very large amounts of existing erosion were measured on a few of the plots, however, and existing erosion was found to be considerably higher than the amount estimated from the critical site equations. For example, one of the road plots had a culvert that had carved an exceptionally large gully below its outlet, while another had large amounts of cut and fill slope erosion 50 feet from a Class II stream. Therefore, the potential for producing large erosion events is clearly evident in this terrain, even though the critical site equations did not generate exceptionally large estimates.

The terrain slope and distance to a Class II stream were used as an index of the proportion of erosion which would become

sediment. The average sediment delivery was found to be much higher than is commonly assumed in forested watersheds. This is due to very high delivery from relatively few plots with extensive amounts of existing erosion. Long-term sediment data does not exist for Soquel Creek at the USGS gaging station; the nearest station with long-term discharge records and a reasonable sediment record is found on the San Lorenzo River at Big Trees State Park. Statistical analyses have indicated that peak storm discharges on Soquel Creek are significantly related to those of the San Lorenzo River. The peak storm discharge/annual sediment yield relationship generated for the San Lorenzo River was then used to estimate the annual sediment yield at Soquel Creek.

Extreme natural variability in sediment yield for Soquel Creek was found for 1952 to 1990, with the range spanning several orders of magnitude. The estimate of mean annual sediment yield based on the stream discharge record for Soquel Creek was somewhat higher than that calculated based on hillslope erosion plot measurements (documenting the impacts of roading and past harvesting). Due to the assumptions involved in making these estimates, however, it is unlikely that these estimated sediment yields are significantly different. Both estimates of sediment discharge for Soquel Creek are high for forested areas and illustrate the erosive nature of the basin. It is unlikely, however, that the limited timber harvesting and rebuilding of abandoned roads planned for SDSF will significantly elevate the erosion rate and have a significant adverse impact on the aquatic system. The anticipated sediment production from SDSF's timber production is small compared to the range of variability in sediment flux observed in this basin.

CONCLUSIONS

In summary, it can be stated that the East Branch of Soquel Creek watershed is a highly sensitive basin. This is due to its inherent natural hillslope instability related to seismic forces, steep slopes, weak bedrock, and frequent high intensity rainfall. Impacts from past management activities, prior to modern California Forest Practice Rules, have contributed greatly to degraded conditions in the basin. In spite of these problems, the East Branch below Ashbury Gulch has not been overwhelmed with sediment, and it is clear from abundant observations of steelhead redds (gravel beds where female fish lay eggs) and young fish that spawning and rearing habitat remains.

The East Branch system is stressed by fine sediment moving downstream from tributaries and the San Andreas Fault Zone. This material is filling pools, and overdrafting of water in low flow summer months compounds the problem. As a result, the aquatic environment is sensitive to further degradation and timber operations must be carried out with extra caution.

Due to the sensitivity of the hillslopes and current channel conditions, special considerations will be needed when planning forest management activities in the East Branch. Appropriate

mitigations must be utilized and remedial improvements implemented to repair existing problem areas. If these considerations are employed, future timber sales can occur without further degradation to the beneficial uses of the basin.

MONITORING AND ENHANCEMENT

Ongoing management of SDSF will involve maintaining proper drainage along roads and trails by repairing culverts, water bars, and other structures to reduce or prevent soil erosion and stream sedimentation. An active watershed remediation program will be developed that includes monitoring watershed conditions and implementing enhancement projects. Monitoring includes a forestwide inventory of stored sediments and active landslides, and mapping mass wasting hazards and surface erosion potential in Amaya Basin. Landscape risk-reduction projects will be rated for cost-effectiveness and implemented in conjunction with future timber operations according to their priority as available funding permits.

PUBLIC COMMENTS AND CONCERNS

Public comments regarding the East Branch watershed have focused on its distinction and sensitivity. Individuals are concerned that forest management activities will result in general watershed degradation, including siltation of streams and excessive erosion. This is particularly important to them in regards to steelhead numbers and habitat and possible impacts upon their land during high intensity rainfall. As stated in this and other chapters, careful pre-project evaluation and measures to ensure the maintenance of watershed integrity are a priority for SDSF. The CWE assessment discussed above and other studies will help the Forest staff understand and manage for the sensitive nature of the basin.

MANAGEMENT GUIDELINES

1. Design streamside management zones that properly address the inherently unstable nature of the East Branch watershed in SDSF. This may include extending zone widths beyond the standards set by the California Forest Practice Rules, as is appropriate in sensitive areas. These zones must provide for the long-term recruitment of large woody debris, protection of the stream channels and banks, and prevention of significant ground disturbance.
2. Place heavy emphasis on road design and maintenance, since roads produce the most sediment in the forest environment. New seasonal and temporary roads should be outsloped to avoid concentrating water that could trigger landslides or transport sediment directly into flowing streams. Of

foremost concern for new road construction is the avoidance of localized unstable areas. For mainline roads, drainage structures must be adequately sized to ensure that the chance of failure is minimized. Roads no longer needed must be properly abandoned. Wet weather use for roads impacting flowing streams should not occur and an active winter maintenance program is needed to ensure that drainage structures are adequately functioning. (Refer to the Roads And Other Improvements chapter for more information.)

3. No tractor operations will be permitted on slopes which average more than 35 percent without site-specific evaluations of slope stability and erosion potential. This will depend on the ability to mitigate such operations to levels of insignificance.

PLANNED ACTIONS

1. Develop a document that will record data on all timber operations activities done in the Forest that could influence soil and water resources. This document, titled Timber Operations History, will become part of an ongoing watershed assessment. For example, information on road construction and harvesting dates as well as the harvesting systems and site preparation techniques utilized would be recorded and mapped.
2. Develop a simple long-term in-channel monitoring program to document changes in the critical component of pool space for anadromous fisheries. Pool space can be used to evaluate and monitor channel conditions and detect and evaluate sediment sources. Sedimentation levels will be monitored at a minimum of four pools. The same pools will be monitored annually through 1999 and periodically thereafter. (Refer to Appendix C, Monitoring Plan.)
3. Inventory, delineate, describe, and risk-rate active landslides and substantial unconsolidated concentrations of sediment and debris in the Forest by June 30, 1999. Also, identify, design, and prioritize feasible projects to reduce the risk of failure of high- or extreme-risk landslides and sediment-debris stores, and estimate the cost-effectiveness of each such project by June 30, 1999. A certified engineering geologist will be consulted for these projects. (Refer to Appendix C, Monitoring Plan.)
4. Evaluate the performance of each previously-implemented remediation project to determine the success in reducing the risk of large-scale sedimentation. Redesign and modify any project not meeting its intended objective. (Refer to Appendix C, Monitoring Plan.)

5. Prepare a map of Amaya Basin depicting risk of mass movement by December 31, 1998. The map will delineate risk classes for deep-and shallow-seated mass movements and for surface erosion. A certified engineering geologist will be consulted for this project. (Refer to Appendix C, Monitoring Plan.)

ARCHAEOLOGY

INTRODUCTION

An archaeological and historical field survey of SDSF was conducted during the summer of 1991. The chief investigator was Dr. Brian Dillon, a consulting archaeologist associated with the California State University at Northridge. In March of 1992, an archaeological and historical report was generated from the survey. In addition to study results, this report also includes information from an archival records research and an extensive oral history interview process. During the survey, Dr. Dillon and his crew discovered six archaeological sites within the State Forest boundaries: two prehistoric and three historic sites as well as one site with both prehistoric and historic features.

The significance of each site was determined by its archaeological and historical value, as outlined in state and federal guidelines. Significance, as defined by these guidelines, is based on uniqueness and preservation, with both considered in the determination of a site's value. Unique refers to how many other similar features exist (on other sites), while preservation refers to the condition of the features remaining on the site. A site is not considered significant if it, although unique, has been completely destroyed as there is nothing left to protect or study.

A confidentiality policy exists which limits public disclosure of sensitive archaeological and historical resources. Consequently, site locations in SDSF with moderate to high levels of significance will not be revealed to the general public. The confidentiality policy protects the resources from artifact collection, site excavation, and vandalism. The policy was approved by the State Historical Resources Commission under authority of Public Resources Code Section 5020.4 (c).

For a detailed account of the archaeology and history of SDSF, refer to Dillon's Archaeological and Historical Survey of Soquel Demonstration State Forest, Santa Cruz County, California (1992). The following is a brief description of the six archaeological sites found in SDSF and a discussion of their significance, as determined by Dillon.

PREHISTORIC SITES

The prehistoric era is believed to have begun on the central coast about 4,000 years ago. The most active times were during the Late Prehistoric Period, 1000 - 1600 AD, when hundreds of sites were established. The prehistoric sites found in SDSF are from this Late Prehistoric Period.

SITE DESCRIPTIONS

CA-SCR-296

This site contains bedrock mortars and rock art. It may also contain subsurface deposits. The rock art consists of multiple cupules on a bedrock boulder, and is the only one recorded on the Pacific Coast between Monterey and Marin Counties. The site was probably a temporary camp set up during the summer and fall months to collect acorns and to fish for steelhead. The uniqueness and preservation of this site are both high, and it has the highest level of significance of all the sites found within SDSF.

CA-SCR-297/H

This site has both prehistoric and historic features. The prehistoric feature is a bedrock boulder with multiple mortars. It is well preserved but not unique, and therefore has a low level of significance. Combined with the historic features, the site has a moderate level of significance.

CA-SCR-298

This site contains a bedrock boulder with a single mortar hole. It is well preserved, but not unique to the county or the state. The site has a significance value of low.

HISTORIC SITES

The Historic Period began along the central coast in 1769 and continues to the present day. The historic sites found in SDSF span from the Mexican Period, 1822 - 1848, to the Anglo-American Period, 1848 to present. The most recent site in the Forest, however, dates back to World War II.

SITE DESCRIPTIONS

CA-SCR-297/H

As previously mentioned, this site contains both prehistoric and historic features. The historic feature is, according to Dillon, "a split-redwood corral dating to the depression era of the 1930's." It is interesting to note that this corral is now located in a dense stand of second-growth redwoods, whereas 60 years ago it must have been an open site. The corral is fairly well preserved and considered unique regarding forest recovery. Historically, the significance value is high, but overall, including the low prehistoric significance value, the site has a moderate level of significance.

CA-SCR-299H

This site contains a mill that was in use until the mid-1940's. The buildings surrounding the mill were bulldozed in the 1960's. The site is neither unique nor well preserved and has a low significance value.

CA-SCR-300H

This site contains a sawpit that was used 150 years ago to saw large logs into smaller sizes. The sawpit is fairly well preserved and somewhat unique. The significance level for this site is moderate.

CA-SCR-301H

This site contains the sulphur baths and resort that were very popular from the late 1870's to the early 1920's. Unfortunately, it has not been well preserved, though it is somewhat unique. The significance level for the site has been determined to be moderate.

PUBLIC COMMENTS AND CONCERNS

Following completion of the archeological study in SDSF, members of the public expressed a desire to learn about Dr. Dillon's discoveries and their significance. Individuals were interested in research or other studies that might result from the findings as well as seeing the archeological sites. Eventually, all sites of moderate and high significance will be more thoroughly evaluated and, depending on the results, may be available for public viewing.

MANAGEMENT GUIDELINES

1. Archaeological and historical sites will be protected, especially during planning and management activities including timber harvesting, recreation, and forestry education.
2. Sites with moderate to high significance value will be preserved and kept confidential, as per the State Historical Resources Commission and Public Resources Code. If, after thorough and careful study, it is determined that certain sites can endure limited public use, they may be made accessible to the community.
3. Educational opportunities, including the display of resilient historic features, will be incorporated into SDSF's Demonstration and Forestry Education programs.

PLANNED ACTIONS

1. Provide the opportunity for scientific study and research of all archaeological and historical resources. Researchers working with sites of moderate or high significance will be expected to uphold all confidentiality policies.
2. After extended study of all archeological sites, create interpretive material for those sites determined to be safe from public harm. Information may be made available through signs, brochures, and staff or docent-led tours of historical areas.
3. Research additional historic information including maps, photographs, written documents, and interviews.

ROADS AND OTHER IMPROVEMENTS

SDSF FACILITIES

The first development of roads within SDSF can be traced back to the mid-nineteenth century. According to local historian Ron Powell (Rancho de Palo de Yesca: the Soquel Augmentation Rancho, n.d.), the Santa Cruz Gap Turnpike (an arterial between Santa Cruz and the Santa Clara valley) was completed in May of 1856. This road included parts of what are now Hihn's Mill Road, Long Ridge Road, and Spanish Ranch Road. Further development of roads occurred when Frederick A. Hihn acquired the SDSF property in 1864.

In the 1870's, Hihn built Sulphur Springs Road to reach his Sulphur Springs Resort as well as a private road for logging and mill access. These roads, along with segments of the Santa Cruz Gap Turnpike, created what is now known as Hihn's Mill Road. This route extends from the Olive Springs Quarry to the parking area off Highland Way and originally included most of what is now Sulphur Springs Road. Additionally, logging by Jared and Seth Comstock in 1878 led to the construction of Comstock Mill Road and portions of Robinwood Lane.

The remainder of the roads in SDSF were constructed by the three timber companies that owned the property after Hihn. This later road construction started with the Monterey Bay Redwood Company in 1924, continued through the CHY Company ownership in the 1960's and 1970's, and ended with the Pelican Timber Company in the 1980's. Figure 15 shows the locations of all existing forest and access roads.

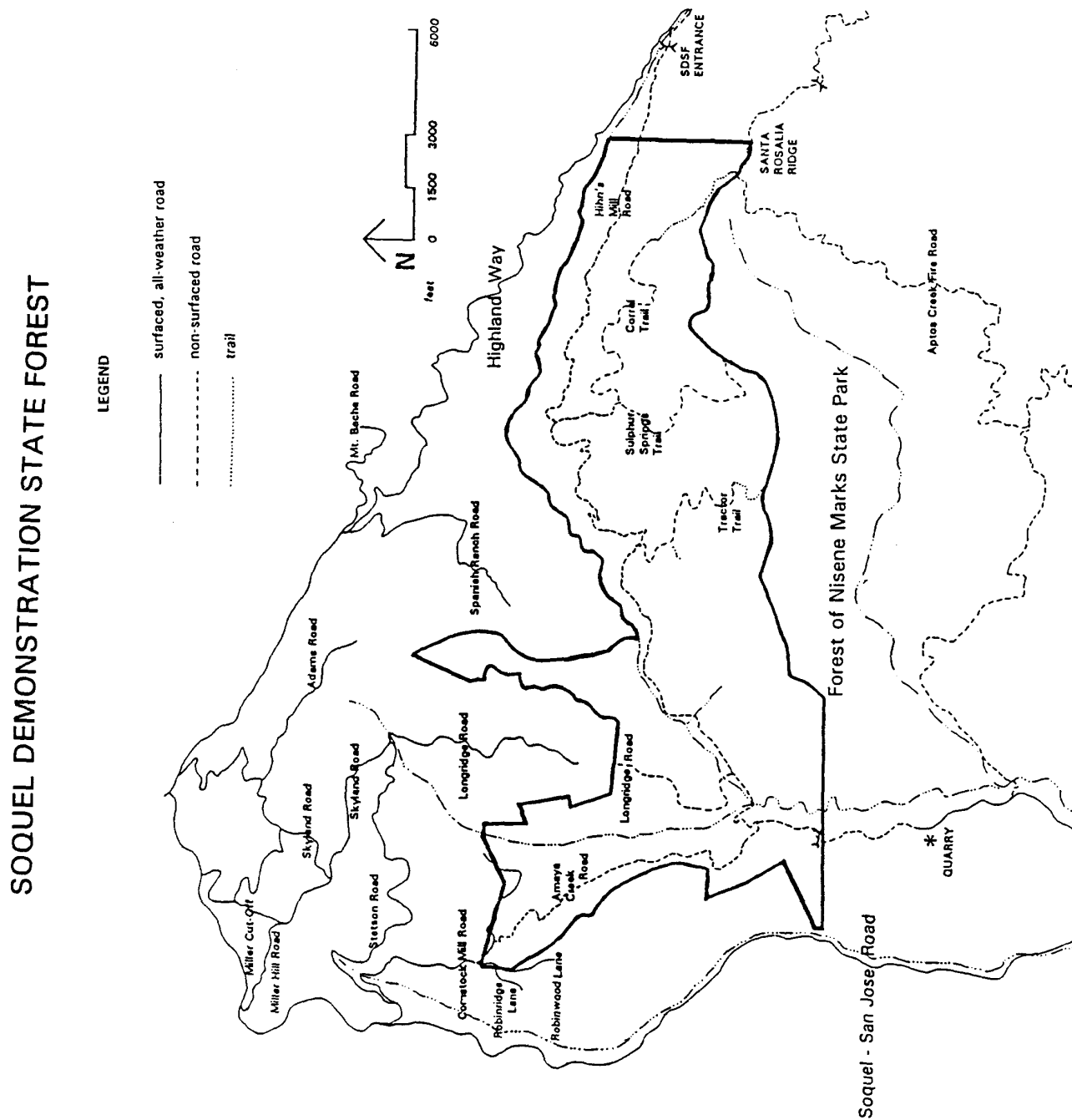
The only portion of SDSF that does not contain roads is the area south of Badger Springs to Santa Rosalia Ridge. This area is bordered by Sawpit Trail (see the Recreation chapter for information on trails) on the east, the East Branch of Soquel Creek on the northwest, and the Forest boundary on the south. Steam Donkeys were used to log this section prior to the introduction of crawler tractors, so no major roads or trails were built. Scars on the slopes above Badger Springs are still evident from this type of logging.

The only bridge associated with SDSF crosses the East Branch at the Highland Way entrance. It is a narrow nine-foot wide railroad car bridge supported by earthen abutments. This bridge and the nearby parking area are located on the Burch property.

LEGAL ACCESS

When the State acquired the major portion of the Pelican Timber Company's holdings along the East Branch in 1988 (refer to the Administration chapter for details), the property was

Figure 15. Drivable roads of SDSF and surrounding area.



inaccessible from county roads. The Forest is surrounded by private property on three sides and The Forest of Nisene Marks State Park (largely undeveloped) to the south. To ensure access, two deeded right-of-ways through private property were granted at the time of acquisition, providing for both administrative and public access.

The first right-of-way is through the Burch property to the east of SDSF. This route includes 0.7 miles of Hihn's Mill Road out to Highland Way, and provides the only public vehicular access to SDSF. (Vehicles are not allowed in the Forest but can drive to and park in a designated area just off of Highland Way.) The second right-of-way is through the CHY Company property to the southwest of SDSF and includes 1 mile of Hihn's Mill Road from the Forest boundary to the Olive Springs Quarry. Olive Springs Road, which connects with the major arterial of Soquel-San Jose Road, can then be accessed through the quarry for administrative purposes only.

DRIVABLE ROADS

All drivable roads in SDSF have been evaluated for safety and stability and are open to varying degrees of seasonal vehicular use. A number of old logging roads and constructed skid trails in the Forest, however, still need to be accurately mapped and have their suitability for reuse determined. Table 8 is a summary of the drivable roads in SDSF with information on the road name, length, and location.

PUBLIC ACCESS ROADS

County roads leading to SDSF access points include Olive Springs Road, Highland Way, and Eureka Canyon Road. Olive Springs Road provides reliable year-round administrative access through the Olive Springs Quarry. As mentioned above, this road connects with Hihn's Mill Road at the southwestern edge of the Forest. This route from the quarry has a rock surface and is generally open.

Highland Way, which is east of Soquel-San Jose Road, leads to the eastern portion of SDSF and, as previously mentioned, provides the only public vehicular access. Highland Way has been unreliable during recent winters, however, due to landslide closures. Eureka Canyon Road, which winds through the mountains from Corralitos, provides a longer alternate route to the Highland Way entrance. Eureka Canyon Road is typically used when closures block Highland Way but is also subject to slides. The Aptos Creek Fire Road, located within The Forest of Nisene Marks State Park, provides administrative access as well as a public entrance (by foot or bicycle) at the east end of Ridge Trail.

Table 8. Drivable road segments of SDSF.

ROAD NAME	LENGTH	LOCATION
Hihn's Mill Road	7.0 miles	Highland Way to Olive Springs Road
Amaya Creek Road	2.0 miles	Hihn's Mill Road to Comstock Mill Road
Comstock Mill Road	0.7 miles	Robinwood Lane to private property
Sulphur Springs Trail	1.5 miles	Hihn's Mill Road to Ridge Trail
Corral Trail	1.2 miles	Sulphur Springs Trail to the end of roaded portion of Corral Trail
Tractor Trail	1.3 miles	Hihn's Mill Road to end of roaded portion of Tractor Trail
Longridge Road	1.5 miles	Hihn's Mill Road to private property

ROAD BUILDING AND MAINTENANCE

Road building and maintenance are critical elements of forest management. Forest roads are the largest potential source of erosion and they provide the means to recreate, harvest timber, access emergency situations, maintain facilities, and patrol the Forest. Therefore, they should be in the best possible condition at all times. Culverts, water bars, rolling dips, and drainage ditches, structures which divert water away from or off of roads, need to be regularly inspected and repaired as necessary. Winter inspection is crucial as the majority of water and topsoil movement occurs during this rainy season. New roads or skid trails will not be constructed or old roads or skid trails rehabilitated without thorough evaluations of topography, intended use, soil stability, drainage capabilities, and construction costs.

There are approximately 19 miles of existing or abandoned roads within SDSF (Refer to Figure 8 Timber Management chapter). About 22 miles of new roads are needed to complete the Forest road network; approximately seven miles of roads would be constructed, and one to two miles of old road would be abandoned during the next ten years. In addition, approximately 15 miles of road proposed for construction will be abandoned eventually.

California Forest Practice Rules specific to road building and maintenance will be applied during all forest management activities. This will be particularly emphasized during timber harvesting operations. These regulations, along with other site-specific strategies, will help minimize erosion, visual disturbance, and road construction. Generally, all construction or rehabilitation of roads will include outsloping of road surfaces, rolling dips, and a minimum of inside ditches. A road management plan will be developed which includes an inventory and risk rating of constructed skid trails and roads, and designs mitigation projects from problem areas.

PUBLIC COMMENTS AND CONCERNS

Since the roads of SDSF will not be available for motorized use by the public, comments regarding them have been minimal. The issue of Forest access, however, is another matter. While most of the access concerns described in the Administration chapter relate to the lack of public entrances, the inadequacy of existing public entrances is a problem as well. Individuals have expressed that the entrances are not only remote, but also difficult to maneuver in some cases. This is particularly true of equestrians who trailer their horses to the Highland Way parking area. As detailed in the Administration chapter and Management Guideline 1 below, SDSF is actively seeking new legal access points. New entrance areas will be designed so that multiple uses can be accommodated.

Another concern is that excessive road building will take place in the Forest. Though SDSF does not have a detailed road construction plan, California Forest Practice Rules place restrictions on the amount and types of roads that can be built in forested areas. It is the intent of the Forest to adhere to these regulations in addition to the examination of all projects and possible impacts on a site-specific basis.

MANAGEMENT GUIDELINES

1. Work with neighboring ownerships to maintain and improve access to the Forest. Continue working with the Olive Springs Quarry and the County of Santa Cruz to ensure that both ends of Hihn's Mill Road remain open.
2. All roads and other improvements shall be monitored and maintained in good condition. This will provide for safety and help prevent surface and mass erosion. Ben Lomond Youth Conservation Camp and California Conservation Corps crews, CDF heavy fire equipment operators, and volunteers will help with road maintenance and repair, as appropriate.
3. New roads and other improvements will be developed as needed for access, resource protection, and forest management activities. High standards and compliance with California

Forest Practice Rules for new logging road construction and existing road rehabilitation to minimize soil damage will be emphasized. New construction and maintenance methods will be researched and incorporated to demonstrate their effectiveness.

PLANNED ACTIONS

1. Develop a road management plan for SDSF. Complete an inventory, assessment, and risk-rating of all existing forest roads by December 31, 1998. An assessment of constructed skid trails will be completed by June 30, 1999. Design mitigation projects for each high- and extreme-risk road segment and estimate the cost-effectiveness of each project by June 30, 1999. (Refer to Appendix C, Monitoring Plan.)
2. Road conditions will be continually assessed to determine which segments are no longer suitable for use. Approximately one to two miles of old road beds will be abandoned over the next 10 years.
3. Investigate and, if possible, acquire additional administrative and public access to SDSF. Alternative funding sources will be examined for these acquisitions as well as for construction and maintenance. (Refer to the Administration chapter for more information on access issues.)
4. Upgrade Hihn's Mill Road and the Highland Way entrance parking area for all-season use. This includes road rocking and replacing culverts at risk of failure with larger culverts. Revise the right-of-way agreement with Burch to clarify maintenance authority and responsibility. Upgrade Longridge, Amaya Creek, and Sulphur Springs Roads for improved emergency access.
5. Widen and provide permanent abutments to the Highland Way entrance bridge in cooperation with Burch/Redwood Empire. Develop a permanent structure for crossing the East Branch via Hihn's Mill Road below the confluence with Amaya Creek.
6. Install trash racks above the inflow to each culvert in the Forest by December 31, 1997. Inventory, assess, and risk-rate each culvert by December 31, 1998. Design projects to reduce the risk of failure of high- or extreme-risk culverts, and estimate the cost-effectiveness of each project by December 31, 1998. (Refer to Appendix C, Monitoring Plan.)
7. Initiate a mile-post system for roads and trails to facilitate management and emergency response.
8. Certify the location of all roads, landings, and skid trails on unstable areas by a certified engineering geologist.

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Wilson, N. July, 1993. Representative of the Fungus Federation.

APPENDICES

APPENDIX A: TEXT OF ASSEMBLY BILL 1965

ASSEMBLY BILL NO. 1965

CHAPTER 1338

An act to add Article 4 (commencing with Section 4660) to Chapter 9 of Division 4 of the Public Resources Code, relating to state forests.

(Approved by Governor September 29, 1987.
Filed with Secretary of State September 29, 1987.)

LEGISLATIVE COUNSEL'S DIGEST

AB 1965, Farr. Soquel Demonstration State Forest.

Under existing law, the Department of Forestry and Fire Protection is authorized to engage in the management, protection, and restoration of state forests in accordance with plans approved by the State Board of Forestry.

This bill would declare it the policy of the state to establish the Soquel Demonstration State Forest in Santa Cruz County. The department would be responsible for the development and establishment of the state forest and for maintenance and operations. The bill would authorize the department to permit a limited amount of commercial timber operations within the forest in order to provide funds for its maintenance and operation. The bill would require the department, in conjunction with a specified advisory committee, to adopt a general plan for the park by January 1, 1989, and would require the general plan to be approved by the advisory committee prior to adoption by the department.

The department's duties and authority under the bill would only arise if the state acquires the property comprising the demonstration forest.

The people of the State of California do enact as follows:

SECTION 1. Article 4 (commencing with Section 4660) is added to Chapter 9 of Division 4 of the Public Resources Code, to read:

Article 4. Soquel Demonstration State Forest

4660. It is hereby declared to be the policy of the state to establish and preserve an intensively managed, multifaceted research forest which is representative of forest activities as a living forest in Santa Cruz County within northern California's coastal redwood belt. The coast redwoods, as the dominant tree species in this area, are a valuable natural resource and are unique in North America for their beauty, abundance, diversity, and public accessibility, and their extreme beauty and economic value requires special measures for their protection for the use, enjoyment, and education of the public.

It is the intent of the Legislature, in establishing the Soquel Demonstration State Forest, to provide an environment that will do all of the following:

(a) Provide watershed protection for local communities and base-line monitoring and studies of the hazards, risks, and benefits of forest operations and watersheds to urban areas.

(b) Provide public education and examples illustrating compatible rural land uses, including sustained yield timber production, as well as the historic development of timbering and forestry machinery, within the context of local community protection and nearby pressures.

(c) Provide a resource for the public, environmental groups, elected officials, environmental planners, the educational community, and the media as an open environment for the inspection and study of environmental education, forestry practices, and effects thereof.

(d) Protect old growth redwood trees.

4661. The department may permit a limited amount of commercial timber operations on the property within the Soquel Demonstration State Forest in order to provide funds for the maintenance and operation of the state forest and to allow fulfillment of the objectives of Section 4660. Income from the state forest property shall sustain all costs of operation and provide income for research and educational purposes.

4662. The department is responsible for the development and establishing of the Soquel Demonstration State Forest and for ongoing maintenance and operations. The director shall appoint an advisory committee to assist the department in planning future management of the forest. The advisory committee shall include representatives of the Santa Cruz County Board of Supervisors, the Department of Parks and Recreation, the Board of Forestry, the Forest of Nicene Marks Advisory Committee, and the Department of Fish and Game.

4663. The department, in coordination with the advisory committee, shall adopt by January 1, 1989, a general plan for the state forest which reflects the long-range development and management plans to provide for the optimum use and enjoyment of the living forest, as provided in Section 4660, as well as the protection of its quality and the watershed within the Santa Cruz area. The general plan shall be approved by the advisory committee prior to adoption by the department.

4664. The duties and authority of the department pursuant to this article shall only arise if the state acquires the property comprising the Soquel Demonstration State Forest.

APPENDIX B: SPECIES LISTS FOR SDSF

FAUNA OF SDSF

From Preliminary Biological Assessment of Soquel Demonstration State Forest, Santa Cruz County, California (Holland et al., 1992) and David Suddjian, Biological Consultant.

SCIENTIFIC NAME

COMMON NAME

FISH

<i>Lampetra tridentata</i>	Pacific lamprey
<i>Oncorhynchus mykiss</i>	steelhead trout
<i>Oncorhynchus gairdnerii</i>	rainbow trout
<i>Gasterosteus aculeatus</i>	northern threespine stickleback
<i>Cottus</i> sp.	sculpin

AMPHIBIANS

<i>Taricha torosa</i>	California newt
<i>Taricha granulosa</i>	rough-skinned newt
<i>Dicamptodon ensatus</i>	Pacific giant salamander
<i>Batrachoseps attenuatus</i>	California slender salamander
<i>Ensatina eschscholtzii</i>	ensatina
<i>Aneides flavipunctatus</i>	black salamander
<i>Aneides lugubris</i>	arboreal salamander
<i>Bufo boreas</i>	western toad
<i>Hyla regilla</i>	Pacific chorus frog
<i>Rana boylei</i>	foothill yellow-legged frog
<i>Rana aurora draytoni</i>	California red-legged frog

REPTILES

<i>Clemmys marmorata</i>	western pond turtle
<i>Sceloporus occidentalis</i>	western fence lizard
<i>Eumeces skiltonianus</i>	western skink
<i>Gerrhonotus multicarinatus</i>	southern alligator lizard
<i>Gerrhonotus coeruleus</i>	northern alligator lizard
<i>Charina bottae</i>	rubber boa
<i>Diadophis punctatus</i>	ringneck snake
<i>Contia tenuis</i>	sharp-tailed snake
<i>Pituophis melanoleucus</i>	gopher snake
<i>Lampropeltis getulus</i>	common kingsnake
<i>Lampropeltis zonata</i>	California mountain kingsnake
<i>Thamnophis sirtalis</i>	common garter snake
<i>Thamnophis elegans</i>	western terrestrial garter snake
<i>Thamnophis couchii</i> ssp. <i>atratus</i>	Santa Cruz garter snake

BIRDS

<i>Ardea herodias</i>	great blue heron
<i>Butorides striatus</i>	green-backed heron
<i>Aix sponsa</i>	wood duck
<i>Mergus merganser</i>	common merganser
<i>Anas platyrhynchos</i>	mallard
<i>Cathartes aura</i>	turkey vulture
<i>Pandion haliaetus</i>	osprey
<i>Accipiter striatus</i>	sharp-shinned hawk
<i>Accipiter cooperii</i>	Cooper's hawk
<i>Buteo jamaicensis</i>	red-tailed hawk
<i>Buteo lineatus</i>	red-shouldered hawk
<i>Aquila chrysaetos</i>	golden eagle
<i>Falco columbarius</i>	merlin
<i>Callipepla californica</i>	California quail
<i>Actitis macularia</i>	spotted sandpiper
<i>Columba fasciata</i>	band-tailed pigeon
<i>Zenaida macroura</i>	mourning dove
<i>Otus kennicottii</i>	western screech owl
<i>Bubo virginianus</i>	great horned owl
<i>Glaucidium gnoma</i>	northern pygmy-owl
<i>Asio otus</i>	long-eared owl
<i>Aegolius acadicus</i>	northern saw-whet owl
<i>Calypte anna</i>	Anna's hummingbird
<i>Selasphorus rufus</i>	rufous hummingbird
<i>Selasphorus sasin</i>	Allen's hummingbird
<i>Ceryle alcyon</i>	belted kingfisher
<i>Melanerpes formicivorus</i>	acorn woodpecker
<i>Sphyrapicus nuchalis</i>	red-naped sapsucker
<i>Picoides pubescens</i>	downy woodpecker
<i>Picoides villosus</i>	hairy woodpecker
<i>Colaptes auratus</i>	northern flicker
<i>Sphyrapicus ruber</i>	red-breasted sapsucker
<i>Empidonax difficilis</i>	Pacific-slope flycatcher
<i>Sayornis nigricans</i>	black phoebe
<i>Myiarchus cinerascens</i>	ash-throated flycatcher
<i>Contopus borealis</i>	olive-sided flycatcher
<i>Contopus sordidulus</i>	western wood-peewee
<i>Cypseloides niger</i>	black swift
<i>Chaetura vauxi</i>	Vaux's swift
<i>Tachycineta thalassina</i>	violet-green swallow
<i>Stelgidopteryx serripennis</i>	northern rough-winged swallow
<i>Hirundo pyrrhonota</i>	cliff swallow
<i>Corvus corax</i>	common raven
<i>Cyanocitta stelleri</i>	Steller's jay
<i>Aphelocoma coerulescens</i>	scrub jay
<i>Parus rufescens</i>	chestnut-backed chickadee
<i>Parus inornatus</i>	plain titmouse
<i>Psaltiriparus minimus</i>	bushtit
<i>Certhia americana</i>	brown creeper
<i>Sitta pygmaea</i>	pygmy nuthatch
<i>Troglodytes troglodytes</i>	winter wren

<i>Thryomanes bewickii</i>	Bewick's wren
<i>Chamaea fasciata</i>	wrentit
<i>Cinclus mexicanus</i>	American dipper
<i>Regulus calendula</i>	ruby-crowned kinglet
<i>Regulus satrapa</i>	golden-crowned kinglet
<i>Polioptila caerulea</i>	blue-gray gnatcatcher
<i>Toxostoma redivivum</i>	California thrasher
<i>Catharus ustulatus</i>	Swainson's thrush
<i>Catharus guttatus</i>	hermit thrush
<i>Turdus migratorius</i>	American robin
<i>Ixoreus naevius</i>	varied thrush
<i>Bombycilla cedrorum</i>	cedar waxwing
<i>Sturnus vulgaris</i>	European Starling
<i>Vireo solitarius</i>	solitary vireo
<i>Vireo huttoni</i>	Hutton's vireo
<i>Vireo gilvus</i>	warbling vireo
<i>Dendroica coronata</i>	yellow-rumped warbler
<i>Dendroica townsendi</i>	Townsend's warbler
<i>Dendroica occidentalis</i>	hermit warbler
<i>Dendroica nigrescens</i>	black-throated gray warbler
<i>Dendroica petechia</i>	yellow warbler
<i>Vermivora celata</i>	orange-crowned warbler
<i>Vermivora ruficapilla</i>	Nashville warbler
<i>Oporornis tolmiei</i>	MacGillivray's warbler
<i>Wilsonia pusilla</i>	Wilson's warbler
<i>Piranga ludoviciana</i>	western tanager
<i>Passerella iliaca</i>	fox sparrow
<i>Melospiza melodia</i>	song sparrow
<i>Melospiza lincolni</i>	Lincoln's sparrow
<i>Zonotrichia atricapilla</i>	golden-crowned sparrow
<i>Zonotrichia leucophrys</i>	white-crowned sparrow
<i>Pipilo erythrophthalmus</i>	rufous-sided towhee
<i>Pipilo crissalis</i>	California towhee
<i>Junco hyemalis</i>	dark-eyed junco
<i>Pheucticus melanocephalus</i>	black-headed grosbeak
<i>Loxia curvirostra</i>	red crossbill
<i>Carpodacus purpureus</i>	purple finch
<i>Coccothraustes vespertinus</i>	evening grosbeak
<i>Carduelis tristis</i>	American goldfinch
<i>Carduelis psaltria</i>	lesser goldfinch
<i>Carduelis pinus</i>	pine siskin

MAMMALS

<i>Didelphis marsupialis</i>	opossum
<i>Sorex trowbridgei</i>	Trowbridge's shrew
<i>Neurotrichus gibbsii</i>	shrew-mole
<i>Scapanus latimanus</i>	broad-footed mole
<i>Myotis lucifugus</i>	little brown myotis
<i>Myotis evotis</i>	long-eared myotis
<i>Myotis volans</i>	long-legged myotis
<i>Myotis californicus</i>	California myotis
<i>Lasionycteris noctivagans</i>	silver-haired bat

<i>Lasiurus cinereus</i>	hoary bat
<i>Pipistrellus hesperus</i>	western pipistrelle
<i>Eptesicus fuscus</i>	big brown bat
<i>Sylvilagus bachmani</i>	brush rabbit
<i>Eutamias merriami</i>	Merriam's chipmunk
<i>Sciurus griseus</i>	western gray squirrel
<i>Thomomys bottae</i>	Botta's pocket gopher
<i>Prognathus californicus</i>	California pocket mouse
<i>Reithrodontomys megalotis</i>	western harvest mouse
<i>Peromyscus truei</i>	pinyon mouse
<i>Peromyscus californicus</i>	California mouse
<i>Peromyscus maniculatus</i>	deer mouse
<i>Neotoma fuscipes</i>	dusky-footed woodrat
<i>Urocyon cinereoargenteus</i>	gray fox
<i>Procyon lotor</i>	raccoon
<i>Mustela frenata</i>	long-tailed weasel
<i>Mephitis mephitis</i>	striped skunk
<i>Canis latrans</i>	coyote
<i>Felis concolor</i>	mountain lion
<i>Lynx rufus</i>	bobcat
<i>Sus scrofa</i>	feral pig
<i>Odocoileus hemionus</i>	black-tailed deer

FLORA OF SDSF

From Preliminary Biological Assessment of Soquel Demonstration State Forest, Santa Cruz County, California (Holland et al., 1992) and Randy Morgan. (Scientific names preceded by * are non-native.)

<i>Acer macrophyllum</i>	bigleaf maple
<i>Acer negundo</i>	California boxelder
<i>Achillea millefolium</i>	yarrow
<i>Adenocaulon bicolor</i>	trail plant
<i>Adiantum jordanii</i>	California maidenhair
<i>Adiantum pedatum</i>	five-finger fern
<i>Aesculus californica</i>	California buckeye
<i>Agoseris grandiflora</i>	large-flowered Agoseris
<i>Agrostis exarata</i> var. <i>pacifica</i>	Pacific bentgrass
* <i>Aira caryophylla</i>	silvery hairgrass
<i>Allium unifolium</i>	one-leaved onion
<i>Allophyllum divaricatum</i>	straggling gilia
<i>Alnus rubra</i>	red alder
<i>Amsinckia intermedia</i>	common fiddleneck
* <i>Anagallis arvensis</i>	scarlet pimpernel
<i>Anaphalus margaritacea</i>	pearly everlasting
* <i>Anthemis cotula</i>	mayweed
<i>Aquilegia formosa</i>	northwest crimson
	columbine
<i>Aralia californica</i>	California spikenard
<i>Arbutus menziesii</i>	madrone
<i>Arctostaphylos andersonii</i>	Santa Cruz mountain
	manzanita
<i>Arctostaphylos crustacea</i>	brittle-leaved manzanita
<i>Arctostaphylos</i> sp.	manzanita
<i>Artemisia douglasiana</i>	mugwort
<i>Asarum caudatum</i>	wild ginger
<i>Aster chilensis</i>	common California sister
<i>Athyrium filix-femina</i>	lady fern
* <i>Avena fatua</i>	common wild oats
<i>Baccharis douglasii</i>	marsh baccharis
<i>Baccharis pilularis</i>	
var. <i>consanguinea</i>	coyote brush
<i>Barbarea</i> sp.	wintercress
<i>Boisduvalia densiflora</i>	dense-flowered
	Boisduvalia
<i>Boykinia elata</i>	coast Boykinia
* <i>Brassica geniculata</i>	perennial mustard
* <i>Brassica nigra</i>	black mustard
* <i>Briza maxima</i>	rattlesnake grass
<i>Briza minor</i>	little quaking grass
<i>Brodiaea elegans</i>	harvest brodiaea
<i>Brodiaea laxa</i>	Ithuriel's spear
<i>Bromus carinatus</i>	California brome
* <i>Bromus diandrus</i>	ripgut brome
* <i>Bromus mollis</i>	soft chess brome
* <i>Bromus rubens</i>	red brome

<i>Bromus vulgaris</i>	woodland brome
<i>Calamagrostis rubescens</i>	wild morning glory
<i>Calystegia occidentalis</i>	pine grass
<i>Campanula prenanthoides</i>	bellflower
<i>Cardamine oligosperma</i>	few-seeded bittercress
* <i>Carduus tenuiflorus</i>	slender-flowered thistle
<i>Carex bolanderi</i>	Bolander's sedge
<i>Carex globosa</i>	round-fruited sedge
<i>Carex tumulicola</i>	foothill sedge
<i>Ceanothus cuneatus</i>	buck brush
<i>Ceanothus papillosus</i>	warty-leaved ceanothus
<i>Ceanothus thyrsiflorus</i>	blue brush
* <i>Centaurea melitensis</i>	tocalote
* <i>Centaurea solstitialis</i>	yellow star thistle
<i>Chlorogalum pomeridianum</i>	soap plant
<i>Cirsium brevistylum</i>	Indian thistle
* <i>Cirsium vulgare</i>	bull thistle
<i>Clarkia purpurea</i> ssp. <i>viminea</i>	large godetia
<i>Collomia heterophylla</i>	varied-leaved Collomia
* <i>Conium maculatum</i>	poison hemlock
<i>Conyza canadensis</i>	horseweed
<i>Cornus californica</i>	western red or creek dogwood
* <i>Cortaderia jubata</i>	pampas grass
<i>Corylus cornuta</i>	California hazel
* <i>Cynosurus echinatus</i>	dog's-tail grass
<i>Cyperus eragrostis</i>	tall cyperus
* <i>Dactylis glomerata</i>	orchard grass
<i>Dentaria californica</i>	milkmaids
<i>Deschampsia elongata</i>	slender hairgrass
<i>Diplicus aurantiacus</i>	sticky monkeyflower
<i>Dichelostemma pulchellum</i>	blue dicks
<i>Disporum hookeri</i>	Hooker's fairy bells
<i>Dryopteris arguta</i>	coastal wood fern
<i>Elymus glaucus</i>	western ryegrass
<i>Epilobium californicum</i>	California willow herb
<i>Epilobium watsonii</i>	Watson's willow herb
<i>Equisetum hiemale</i>	scouring rush
<i>Equisetum telmatiea</i>	horsetail
* <i>Erechtites glomerata</i>	fireweed
<i>Eriodictyon californicum</i>	California mountain balm
<i>Festuca occidentalis</i>	western fescue
<i>Filago californica</i>	California Filago
<i>Fragaria californica</i>	California strawberry
<i>Fritillaria lanceolata</i>	checker lily
* <i>Galium aparine</i>	goosegrass
<i>Galium californicum</i>	California bedstraw
<i>Galium porrigens</i>	climbing bedstraw
<i>Galium triflorum</i>	trifid bedstraw
* <i>Gastridium ventricosum</i>	nitgrass
* <i>Genista monspessulana</i>	French broom
<i>Gnaphalium californicum</i>	California everlasting
<i>Gnaphalium purpureum</i>	purple cudweed
<i>Gnaphalium</i> sp.	everlasting

<i>Gnaphalium stramineum</i>	cotton-batting plant
<i>Helenium puberulum</i>	sneezeweed
<i>Heracleum maximum</i>	cow parsnip
<i>Heteromeles arbutifolia</i>	toyon
<i>Heuchera micrantha</i>	small-flowered heuchera
<i>Hieracium albiflorum</i>	white-flowered hawkweed
<i>Hierochloa occidentalis</i>	vanilla grass
* <i>Holcus lanatus</i>	velvet grass
<i>Holodiscus discolor</i>	cream bush
* <i>Hordeum leporinum</i>	foxtail barley
* <i>Hypericum calycinum</i>	St. John's wort
* <i>Hypochoeris radicata</i>	hairy cat's ear
<i>Iris macrosiphon</i>	ground iris
<i>Juncus bufonius</i>	toad rush
<i>Juncus effusus</i> var. <i>brunneus</i>	bog rush
<i>Juncus patens</i>	common rush
<i>Juncus xiphioides</i>	iris-leaved rush
<i>Lathyrus vestitus</i>	common Pacific pea
* <i>Lepidium strictum</i>	wayside pepper grass
* <i>Linum bienne</i>	small-flowered flax
<i>Lithocarpus densiflora</i>	tanoak
* <i>Lolium multiflorum</i>	annual ryegrass
<i>Lonicera hispidula</i>	hairy honeysuckle
<i>Lotus eriophorus</i>	wooly trefoil
<i>Lotus purshianus</i>	Spanish clover
<i>Lotus scoparius</i>	deerweed
<i>Lupinus albifrons</i>	bush lupine
<i>Lupinus latifolius</i>	broad-leaved lupine
<i>Lupinus nanus</i>	sky lupine
<i>Luzula multiflora</i>	wood rush
<i>Madia elegans</i>	common Madia
<i>Madia gracilis</i>	slender tarweed
<i>Madia madioides</i>	woodland Madia
* <i>Madia sativa</i>	coast tarweed
* <i>Medicago polymorpha</i>	bur clover
<i>Melica imperfecta</i>	small-flowered melic grass
<i>Melica torreyana</i>	Torrey's melic grass
* <i>Melilotus alba</i>	white sweetclover
* <i>Melilotus indica</i>	yellow sweetclover
* <i>Melissa officinalis</i>	lemon balm
<i>Mimulus cardinalis</i>	scarlet monkeyflower
<i>Montia perfoliata</i>	miner's lettuce
* <i>Myosotis latifolia</i>	forget-me-not
<i>Myrica californica</i>	wax myrtle
<i>Navarretia squarrosa</i>	skunkweed
<i>Nemophila parviflora</i>	small-flowered Nemophila
<i>Osmorhiza chilensis</i>	sweet cicely
<i>Oxalis oregana</i>	redwood sorrel
<i>Petasites palmatus</i>	coltsfoot
<i>Phalaris californica</i>	California canary grass
<i>Pinus attenuata</i>	knobcone pine
<i>Pityrogramma triangularis</i>	goldenback fern
* <i>Plantago lanceolata</i>	English plantain

<i>Plantanus racemosa</i>	California sycamore
<i>Poa howellii</i>	Howell's bluegrass
<i>Polygala californica</i>	California milkwort
<i>Polygonum punctatum</i>	smartweed
<i>Polypodium californicum</i>	California polypody
* <i>Polypogon interruptus</i>	beard grass
* <i>Polypogon monspeliensis</i>	rabbitsfoot grass
<i>Polystichum dudleyi</i>	Dudley's shield fern
<i>Polystichum munitum</i>	western sword fern
<i>Populus trichocarpa</i>	black cottonwood
<i>Potentilla glandulosa</i>	cinquefoil
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Psoralea macrostachya</i>	leather root
<i>Pteridium aquilinum</i>	bracken fern
<i>Quercus agrifolia</i>	coast live oak
<i>Quercus kelloggii</i>	black oak
<i>Quercus wislizenii</i>	interior live oak
<i>Rhamnus californica</i>	California coffeeberry
<i>Ribes menziesii</i>	canyon gooseberry
<i>Ribes sanguineum</i>	
var. <i>glutinosum</i>	flowering current
* <i>Rorippa nasturtium-officinale</i>	watercress
<i>Rorippa palustris</i>	yellow cress
<i>Rosa californica</i>	California wild rose
<i>Rosa gymnocarpa</i>	wood rose
<i>Rubus leucodermis</i>	western raspberry
<i>Rubus parviflorus</i>	thimble berry
<i>Rubus ursinus</i>	California blackberry
* <i>Rumex acetosella</i>	sour dock or sheep sorrel
* <i>Rumex conglomeratus</i>	clustered dock
<i>Salix lasiandra</i>	yellow willow
<i>Salix lasiolepis</i>	sandbar willow
<i>Salix sitchensis</i>	velvet willow
<i>Sambucus mexicana</i>	elderberry
<i>Sanicula crassicaulis</i>	Pacific sanicle
<i>Satureja douglasii</i>	yerba buena
<i>Scirpus microcarpus</i>	panicled bulrush
<i>Scoliopus bigelovii</i>	California fetid adder's tongue
<i>Scrophularia californica</i>	California figwort
<i>Sequoia sempervirens</i>	coast redwood
* <i>Silybum marianum</i>	milk thistle
<i>Sisyrinchium bellum</i>	blue-eyed grass
<i>Smilacina racemosa</i>	western Solomon's seal
<i>Smilacina stellata</i>	slender Solomon's seal
<i>Solanum umbelliferum</i>	blue witch
* <i>Sonchus asper</i>	prickly sow thistle
* <i>Sonchus oleraceus</i>	common sow thistle
* <i>Spergularia</i> sp.	sand spurry
<i>Stachys bullata</i>	hedge nettle
<i>Stachys rigida</i>	hedge nettle
* <i>Stellaria media</i>	common chickweed
<i>Stipa pulchra</i>	purple needlegrass
<i>Symphoricarpos albus</i>	tall snowberry

<i>Symphoricarpos mollis</i>	snowberry
* <i>Torilis arvensis</i>	hedge parsley
* <i>Torilis nodosa</i>	knotted hedge parsley
<i>Toxocodendron diversilobum</i>	poison oak
<i>Trientalis latifolia</i>	Pacific starflower
* <i>Trifolium angustifolium</i>	narrow-leaved clover
* <i>Trifolium hirtum</i>	rose clover
<i>Trifolium tridentatum</i>	tomcat clover
<i>Trillium ovatum</i>	coast trillium
<i>Trisetum canescens</i>	tall trisetum
<i>Typha latifolia</i>	broad-leaved cattail
<i>Umbellularia californica</i>	California bay
<i>Urtica holosericea</i>	stinging nettle
<i>Vaccinium ovatum</i>	huckleberry
<i>Vancouveria planipetala</i>	inside-out flower
<i>Verbena lasiostachys</i>	western verbena
<i>Veronica americana</i>	American speedwell
<i>Veronica peregrina</i>	purslane speedwell
* <i>Vicia sativa</i>	common vetch
* <i>Vinca major</i>	periwinkle
<i>Viola ocellata</i>	two-eyed violet
<i>Viola pedunculata</i>	Johnny jump-up
<i>Viola sempervirens</i>	redwood violet
* <i>Vulpia bromoides</i>	six-week fescue
<i>Whipplea modesta</i>	yerba de selva
<i>Woodwardia fimbriata</i>	western chain fern

FUNGI OF SDSF

From personal communication with Nathan Wilson of the Fungus Federation of Santa Cruz.

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>
<i>Agricus hondensis</i>	felt-ringed <i>Agricus</i>
<i>Amanita gemata</i>	gemmed <i>Amanita</i>
<i>Amanita pantherina</i>	panther <i>Amanita</i>
<i>Amanita phalloides</i>	death cap
<i>Amanita vaginata</i>	grisette
<i>Armillaria mellea</i>	honey mushroom
<i>Camarophyllus borealis</i>	snowy waxy cap
<i>Camarophyllus russocoriaceus</i>	cedar waxy cap
<i>Cantharellus cibarius</i>	chanterelle
<i>Caulorhiza umbonata</i>	redwood rooter
<i>Clitocybe deceptiva</i>	anise mushroom
<i>Clitocybe nebularis</i>	cloudy <i>Clitocybe</i>
<i>Coprinus micaceus</i>	mica cap
<i>Cortinarius</i> sp.	<i>Cortinarius</i>
<i>Cortinarius varius</i>	<i>Cortinarius</i>
<i>Craterellus cornucopioides</i>	horn of plenty
<i>Fomitopsis pinicola</i>	red-belted conk
<i>Gomphidius subrosea</i>	rosy <i>Gomphidius</i>
<i>Gymnopilus sapineus</i>	common <i>Gymnopilus</i>
<i>Gyromitra infula</i>	hooded false morel
<i>Hebeloma crustuliniforme</i>	poison pie
<i>Helvella lacunosa</i>	fluted black elfin saddle
<i>Hygrocybe acutoconica</i>	a cute conic waxy cap
<i>Hygrocybe coccinea</i>	righteous red waxy cap
<i>Hygrocybe conica</i>	witch's hat
<i>Hygrocybe flavescens</i>	golden waxy cap
<i>Hygrocybe punicea</i>	scarlet waxy cap
<i>Inocybe fastigiata</i>	corn silk <i>Inocybe</i>
<i>Lactarius argillaceifolius</i>	vulgar milk cap
<i>Lactarius chrysorheus</i>	yellow-staining milk cap
<i>Lactarius fragilis</i>	candy cap
<i>Lactarius rubrilacteus</i>	bleeding milk cap
<i>Lenzites betulina</i>	gilled polypore
<i>Leptonia parva</i>	blue-black <i>Leptonia</i>
<i>Naematoloma fasciculare</i>	sulfur tuft
<i>Paxillus involutus</i>	poison pax
<i>Phylloporus rhodoxanthus</i>	gilled bolete
<i>Pleurocybella porrigens</i>	angel wings
<i>Pleurotus ostreatus</i>	oyster mushroom
<i>Pluteus cervinus</i>	deer mushroom
<i>Ramaria</i> sp.	<i>Ramaria</i>
<i>Russula brevipes</i>	short-stemmed <i>Russula</i>
<i>Russula cremoricolor</i>	creamy <i>Russula</i>
<i>Russula silvicola</i>	emetic <i>Russula</i>
<i>Stereum hirsutum</i>	hairy <i>Stereum</i>
<i>Trametes versicolor</i>	turkey tail

APPENDIX C: MONITORING PLAN

SOQUEL DEMONSTRATION STATE FOREST MONITORING PLAN

WATERSHED MONITORING

Timber Operations

To avoid adverse impacts on water quality and fisheries resulting from the discharge of sediment to watercourses attributable to timber operations, Soquel Demonstration State Forest (SDSF) staff will monitor all timber operations (including all harvesting areas and new roads, skid trails, and landings) annually for 5-7 years following completion of the operations. Occurrences of substantial surface erosion (i.e., gullies) or mass wasting (i.e., landslides or slumps) resulting from the operations will be identified and described by a registered professional forester (RPF).

Each substantial gully or landslide will be evaluated to determine its cause and identify stabilization measures that would be most feasible, effective, and cost effective. Such measures will be implemented within 90 days from the date when the subject site is identified, unless due cause for delay is explained and a reasonable alternative schedule for implementation is proposed by the SDSF forest manager. If, based on the judgement of a certified engineering geologist (CEG), no stabilization measures are feasible or reasonable to apply to the subject site, feasible offsite watershed remediation measures will be implemented as recommended by the CEG in conjunction with the next timber operation conducted at SDSF.

The SDSF forest manager will describe appropriate mitigation measures to be incorporated into future timber operations and specified in future timber harvesting plans (THPs) to avoid a recurrence of the observed erosion or mass wasting events.

Roads

By December 31, 1998, the California Department of Forestry and Fire Protection (CDF) will inventory, delineate, describe, and risk-rate each segment of forest road at SDSF. A similar inventory of constructed skid trails will be completed by June 30, 1999. This information will be compiled into a database to be maintained on an ongoing basis. The description and risk-rating of segments will focus on conditions affecting the risk that runoff will cause erosion resulting in substantial sediment discharge to a watercourse. Such conditions will include, but are not limited to:

- * presence of inside ditches,
- * stability of fill deposits,
- * adequacy and reliability of drainage structures,
- * grade,
- * potential for a diverted watercourse to be transported down the roadway,
- * proximity to a watercourse, and
- * existing substantial gullies.

By June 30, 1999, CDF will identify and design feasible projects to remediate sediment-discharge risks associated with each high- and extreme-risk road segment and estimate the cost-effectiveness (in dollars per cubic yard of sediment) of each such project. Such projects could include abandonment or recontouring of roads, or installation of improved drainage structures.

Culverts

By December 31, 1997, trash racks will be installed above the inflow to each culvert at SDSF. Any culverts for which trash rack installation is not needed (based on low risk of culvert failure) will be identified and explained by a RPF. The trash racks will be maintained on at least an annual basis, or more frequently if required based on the occurrence of storm events.

By December 31, 1998, CDF will inventory, delineate, describe, and risk-rate each culvert at SDSF. This information will be compiled into a database to be maintained on an ongoing basis. The description and risk-rating of each culvert will focus on the potential for culvert failure to result in diversion of flows and consequent erosion and discharge of sediment to a watercourse. The risk rating will be based on standard engineering criteria for adequate culvert sizing, including effective culvert diameter, extent of tributary area, and intensity of a storm with a 50-year recurrence period.

By December 31, 1998, CDF will identify and design feasible projects to reduce the risk of failure of high-or extreme-risk culverts, and estimate the cost-effectiveness (in dollars per cubic yard of sediment) of each such project. Such projects could include replacement of existing culverts with more reliable drainage structures (e.g., rocked dips) or larger culverts.

Active Landslides and Sediment Stores

By June 30, 1999, CDF, in conjunction with a CEG, will inventory, delineate, describe and risk-rate active landslides and substantial unconsolidated concentrations of sediment and debris at SDSF. This information will be compiled into a database to be maintained on an ongoing basis with new landslides added as they occur. Unconsolidated concentrations of sediment and debris and active landslides identified by Manson and Sowma-Bawcom (1992)

will be included in the database. The description and risk-rating of segments will focus on conditions affecting the likelihood that runoff or seismic activity will cause mass movement resulting in sediment discharge to a watercourse.

By June 30, 1999, CDF will, in conjunction with a CEG, identify and design feasible projects to reduce the risk of failure of high-or extreme-risk landslides and sediment-debris stores, and estimate the cost-effectiveness (in dollars per cubic yard of sediment) of each such project. Landslide risk-reduction projects could include installation of drainage structures on roads above landslides to reduce the discharge of concentrated runoff onto the landslide, or armoring or buttressing of landslide toes. Sediment-debris store risk-reduction projects could include recontouring or removal of material to reestablish original watercourses, bucking of logs in debris piles and using the logs to armor eroding bank faces, or revegetation.

Amaya Basin

To minimize the risk of adverse effects on water quality and fisheries resulting from timber operations in Amaya Basin, by December 31, 1998, CDF will, in conjunction with a CEG, prepare a map of Amaya Basin depicting risk of mass movement. The map will delineate risk classes for deep-and shallow-seated mass movements and for surface erosion.

Remediation Projects

By June 30, 1999, CDF will prioritized all sediment-discharge projects identified and designed to remediate high- or extreme-risk conditions, as described above. Such projects will be implemented in conjunction with future timber operations according to their priority as available funding permits, to ensure, to the extent practicable, that no significant increase in sedimentation results from the timber operations proposed in each THP.

To avoid adverse impacts of implementing remediation projects on water quality and fish habitat, CDF will evaluate the performance of each previously-implemented remediation project to determine whether the project was successful in reducing risk of large-scale sedimentation. Performance monitoring will be conducted following each storm event estimated to have a recurrence period of at least 2 years and continue for at least 4 years. If CDF determines that any project is not meeting its intended objective, CDF will redesign and modify the project as needed.

AQUATIC RESOURCE MONITORING

Fisheries Management Plan

By December 31, 1998, CDF will adopt a Fisheries Management Plan for SDSF specifying in detail all aquatic-resource monitoring activities to be implemented on an ongoing basis, including monitoring frequency and intensity. The aquatic-resource monitoring program will include the first four items described below.

Fish Populations

Fish population surveys will be conducted annually through 1997 and periodically thereafter. Sampling will occur at a minimum of four permanent stations, including stations on the East Branch and Amaya Creek.

Habitat

Aquatic habitat surveys will be conducted at least once every 10 years and, to the extent possible, will use methodologies recommended by the California Department of Fish and Game (DFG).

Pool Sedimentation

Sedimentation levels will be monitored at a minimum of four pools. The same pools will be monitored annually through 1999 and periodically thereafter.

Aquatic Invertebrates

Ecological condition of aquatic habitats will be monitored by sampling of invertebrates using the protocol developed by the U.S. Environmental Protection Agency in cooperation with DFG. Sampling will occur at three stations, including at least two stations where fish population surveys take place, at least annually through 1999 and periodically thereafter.

Habitat Enhancement Structures

Fish habitat enhancement structures will be reviewed and approved by DFG and a qualified hydrologist before installation.

To avoid adverse impacts of habitat-enhancement structures on fish habitat, CDF, in conjunction with DFG, will evaluate structures annually for three years following installation to determine whether they are performing as intended and whether they are causing any unintended adverse impacts on fish habitat.

If CDF and DFG determine that any structure is functioning improperly or is adversely affecting aquatic habitat, CDF will redesign, repair, or remove the structure, as needed.

Fish Poaching and Harassment

To avoid adverse impacts of public use on fish, CDF and DFG will conduct ongoing patrols in SDSF to enforce prohibitions on fishing and fish harassment. Incidents of fishing or harassment will be recorded and compiled. CDF and DFG will evaluate such information annually in conjunction with fish population estimates to determine whether poaching or harassment have had a significant adverse effect on SDSF fisheries. If so, CDF will respond by closing streamside trails and intensifying law enforcement (e.g., increased patrols of streamside roads) as needed to ensure rapid fishery recovery and avoid additional adverse fishery effects.

RIPARIAN RESOURCE MONITORING

To avoid adverse impacts of public use on riparian habitat, CDF will conduct ongoing patrols in SDSF to enforce prohibitions on vandalism and other damage to riparian habitat related to public use. Incidents of damage will be recorded and compiled. A qualified wildlife biologist will evaluate such information annually to determine whether the damage constitutes a significant adverse effect on wildlife. If so, CDF will implement additional restrictions on public use (e.g., prohibiting camping or weekday recreation use or cordoning off of sensitive areas) as needed to ensure rapid habitat recovery and avoid additional adverse wildlife effects.

WILDFIRE MONITORING

To minimize increases in wildfire risks resulting from increased public use at SDSF, CDF will record and compile descriptions of all wildfires occurring at SDSF including ambient weather and fire hazard conditions, ignition source, area and vegetation types burned, and estimated damage. Such information will be evaluated annually to determine whether wildfire incidents have increased substantially in frequency or intensity relative to 1990-1995 conditions. If so, CDF will implement appropriate measures (e.g., prohibiting all fires or weekday recreation use, or allocating additional fire-suppression resources for SDSF) as needed to reduce wildfire risks.

EMERGENCY SERVICES MONITORING

To minimize adverse effects on emergency response performance for residents of Santa Cruz County resulting from increased demands for such services at SDSF, CDF will record and compile all requests for emergency responses, including requests for police, fire medical, or search and rescue services. Descriptions of emergency responses will include response times. Such information will be evaluated annually to determine whether the demand for emergency services or average emergency response time has increased substantially relative to 1990-1995 conditions. If so, CDF will enhance its emergency response capability by upgrading roads; developing additional helispots along remote trails; and, either directly or through a management agreement with another qualified entity, providing additional human and equipment resources for emergency response at SDSF.

NUISANCE MONITORING

To minimize nuisance impacts on SDSF neighbors, CDF will record and compile descriptions of all reported nuisances caused by SDSF users at SDSF or on adjacent ownerships including, but not limited to, trespass, vandalism, littering, and noise. CDF will organize and supervise a volunteer patrol force to assist in this effort. Nuisance reports will be evaluated annually to determine whether nuisance incidents had increased substantially in frequency or intensity relative to 1990-1995 conditions, and whether such a trend constitutes a significant adverse impact on neighbors. If so, CDF will implement additional restrictions on public use (e.g., prohibiting weekday recreation use) and intensified law enforcement (e.g., increased patrols) to ensure that nuisances caused by SDSF users are minimized.

PUBLIC-USE MONITORING

CDF will use camping records, surveys and other information to compile annual estimates of public use of SDSF in user days. Use will be estimated for specific activities including, but not limited to, mountain biking, camping, equestrian use, and educational activities.

CITATION

Manson, M.W., and J.A. Sowma-Bawcom. 1992. Geology, slope stability, and earthquake damage in Soquel Demonstration State Forest. California Department of Conservation, Division of Mines and Geology. Sacramento, CA.